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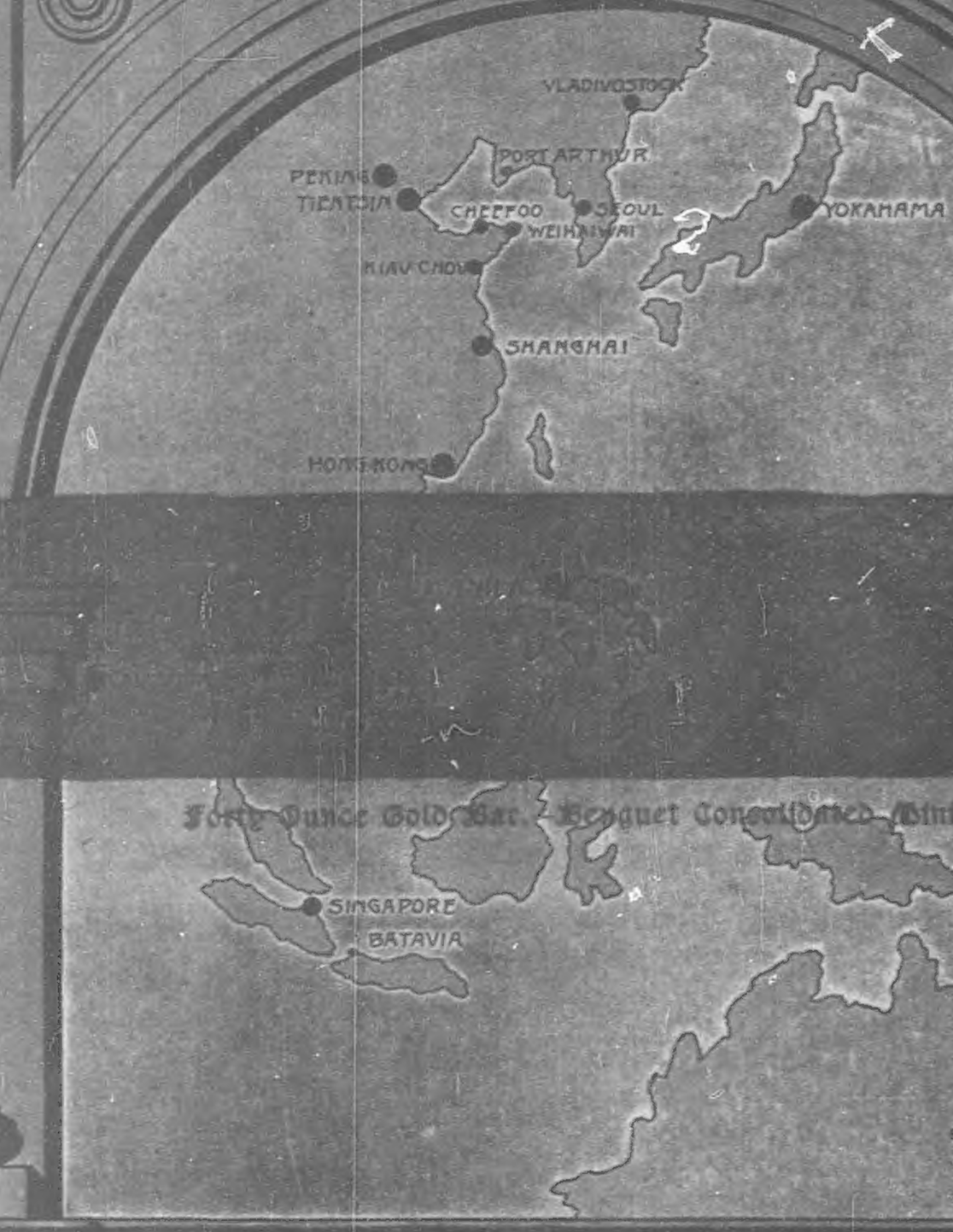
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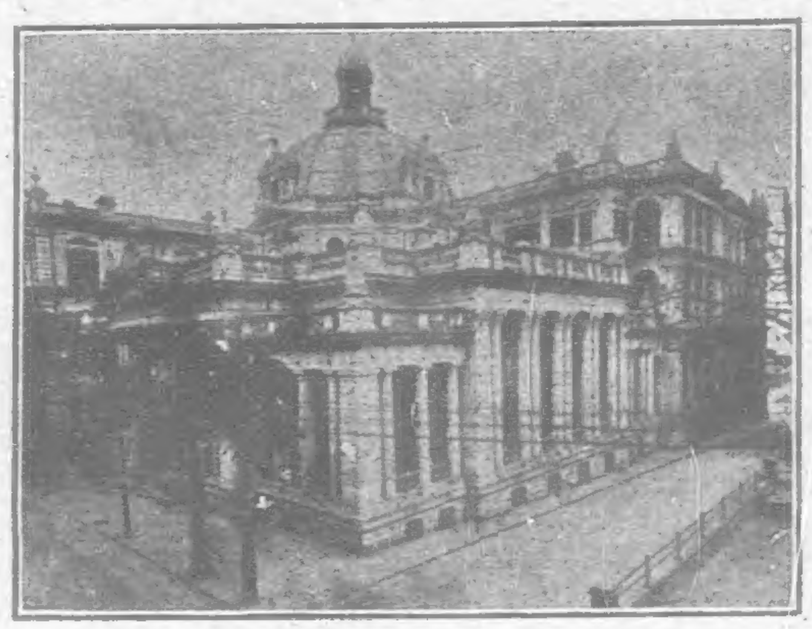
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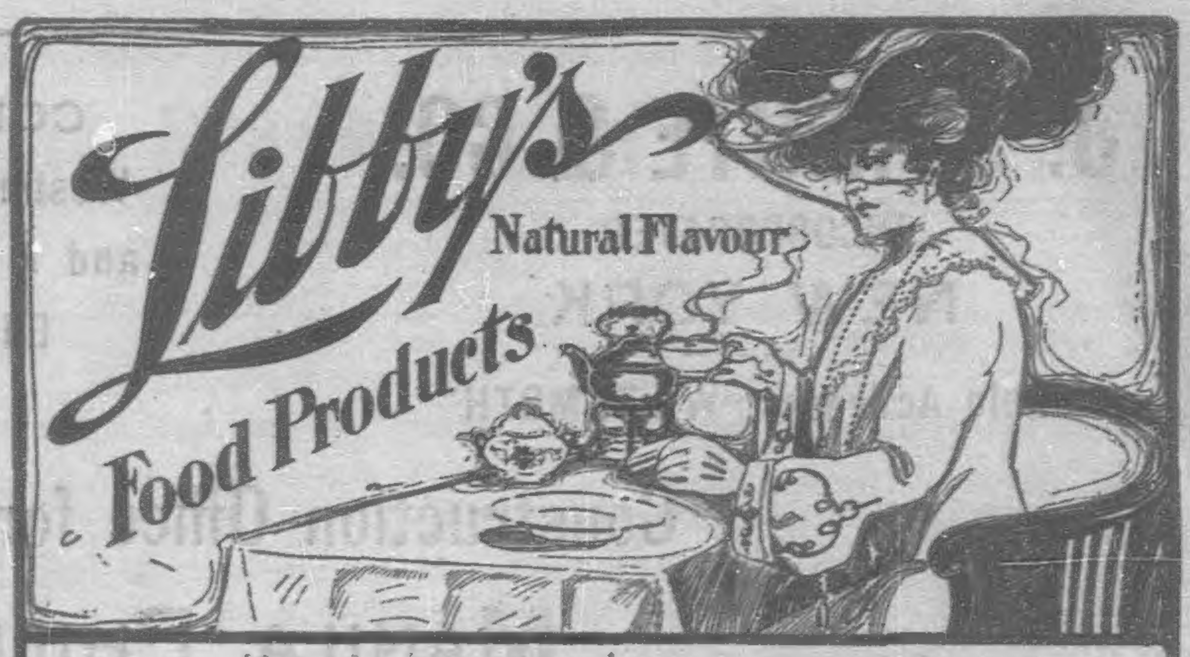
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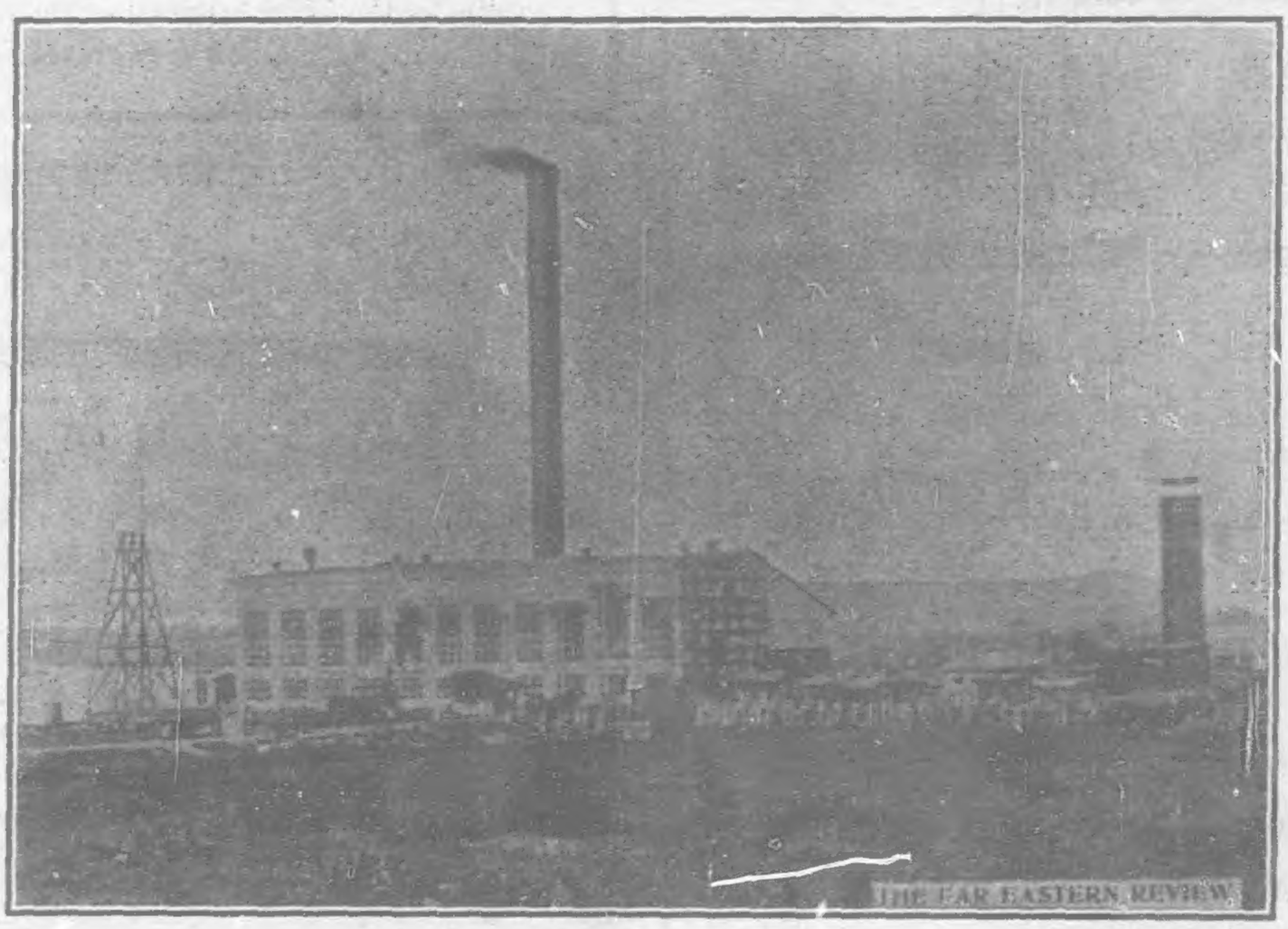
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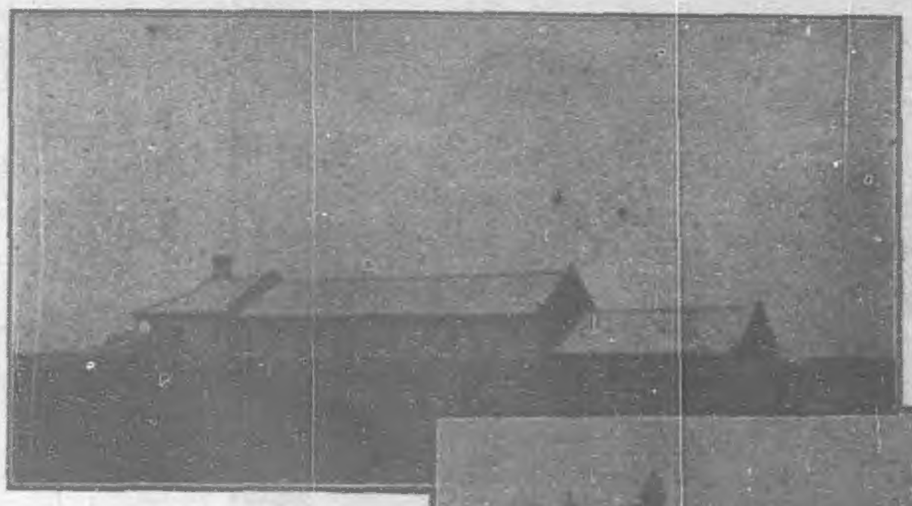
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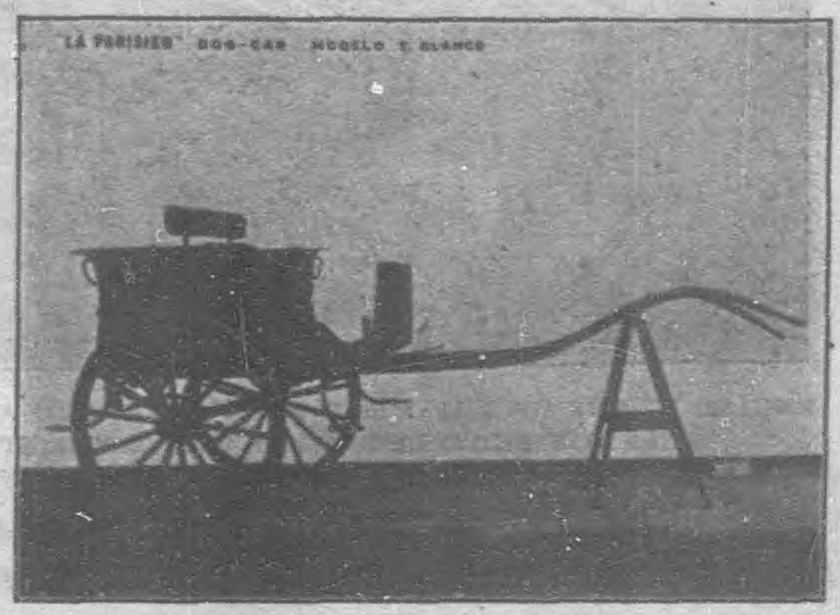
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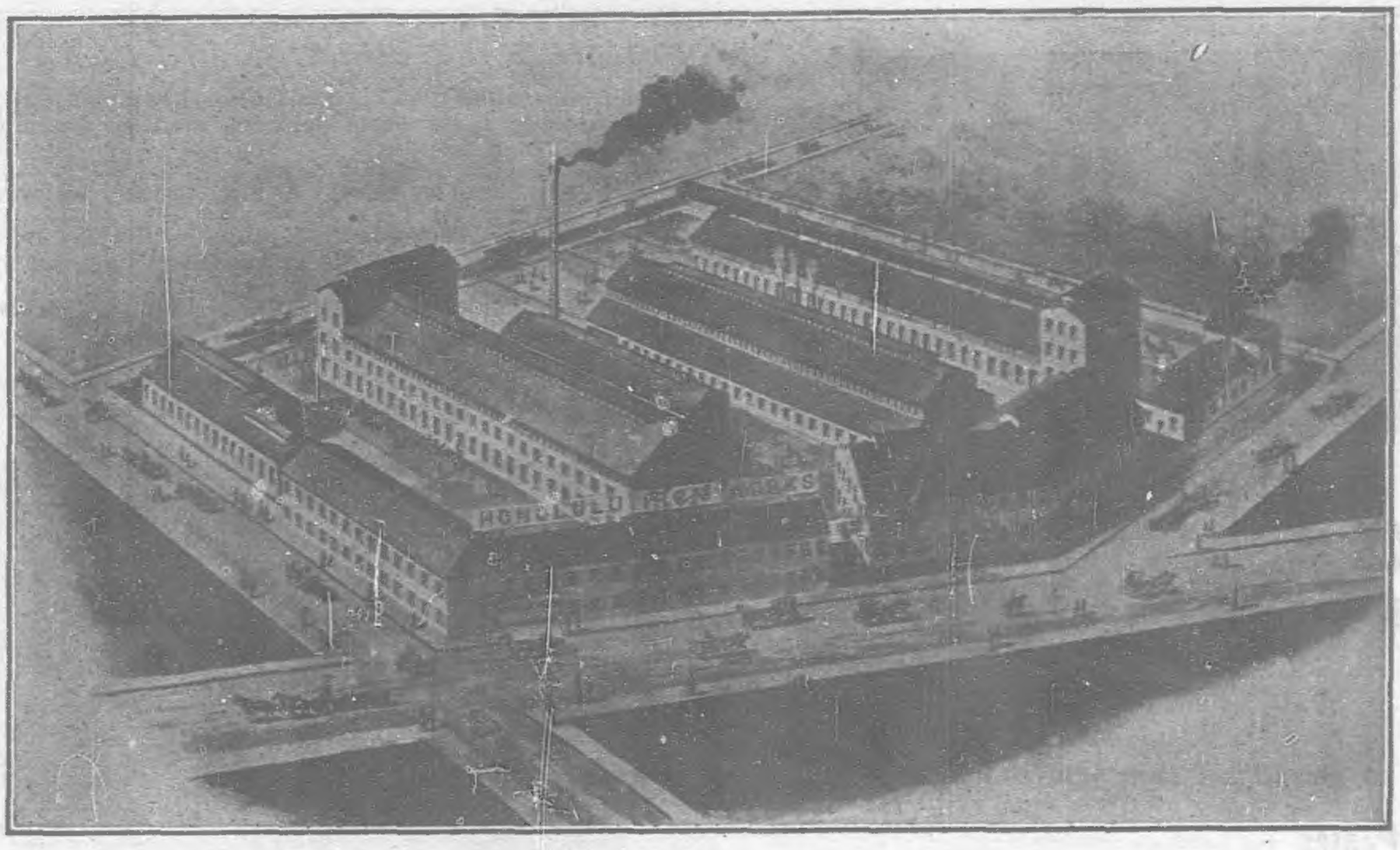
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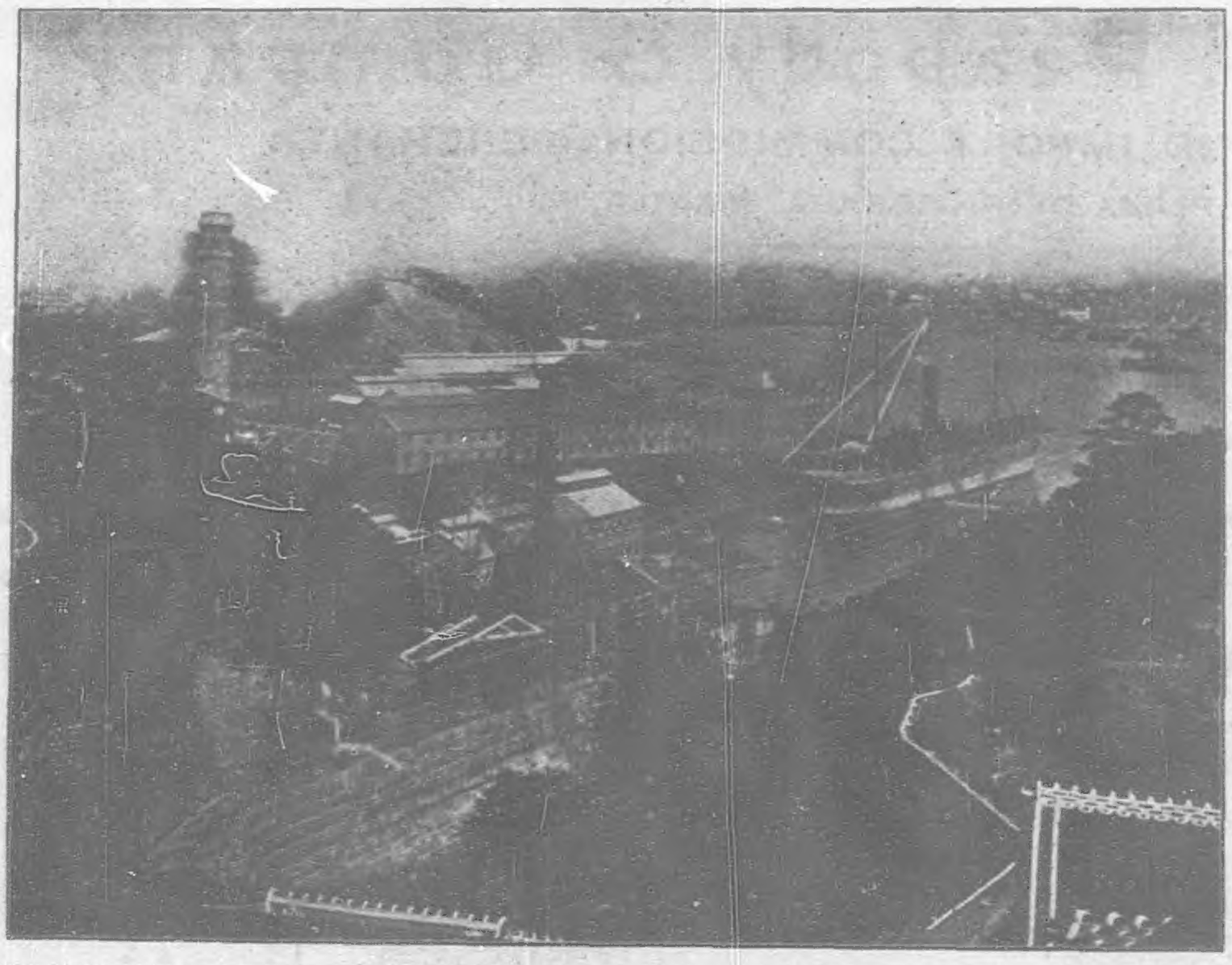


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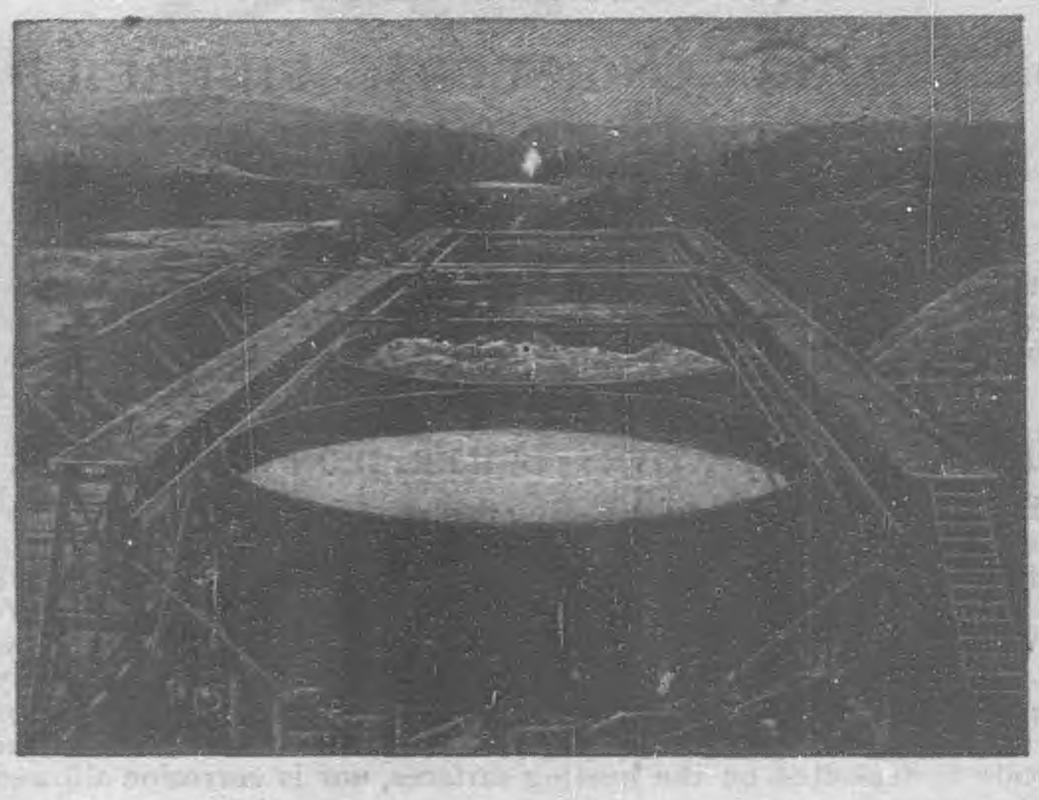
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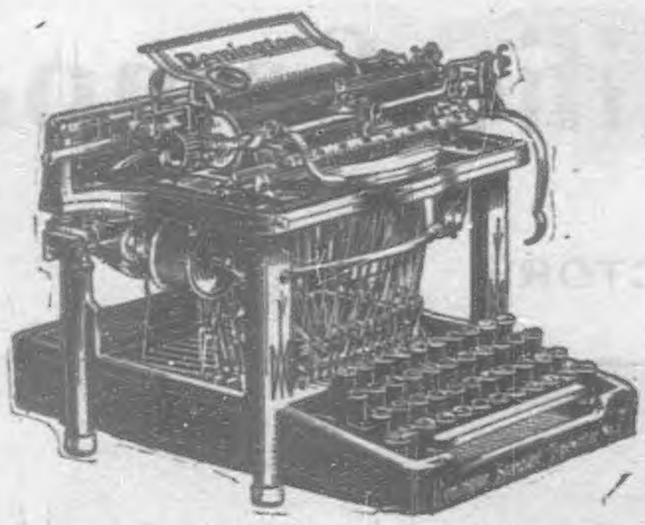
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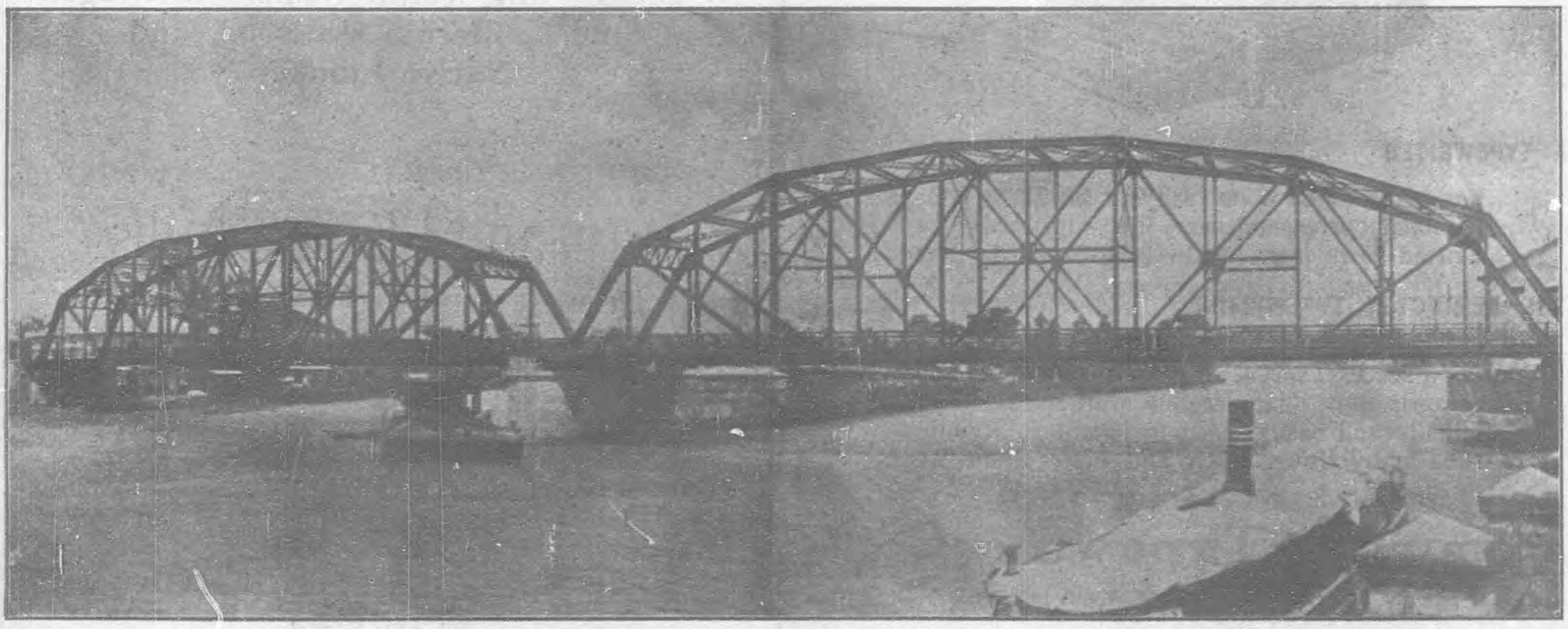
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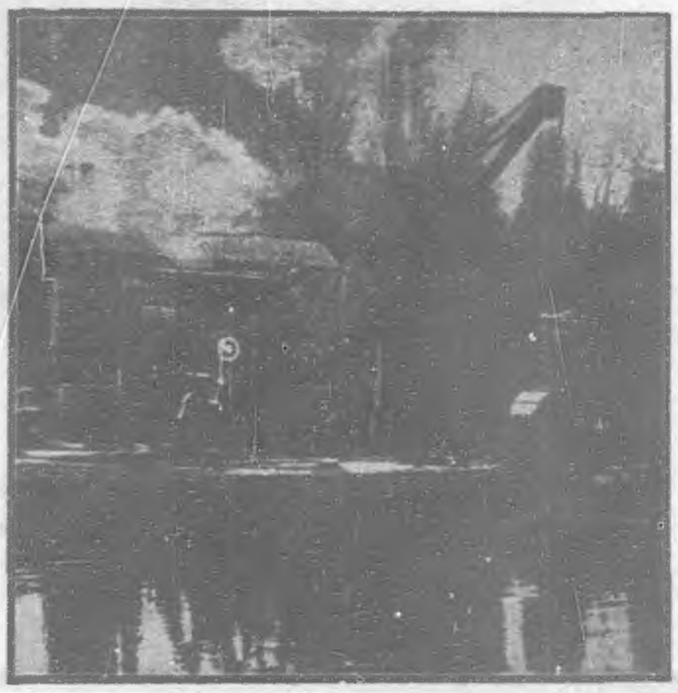


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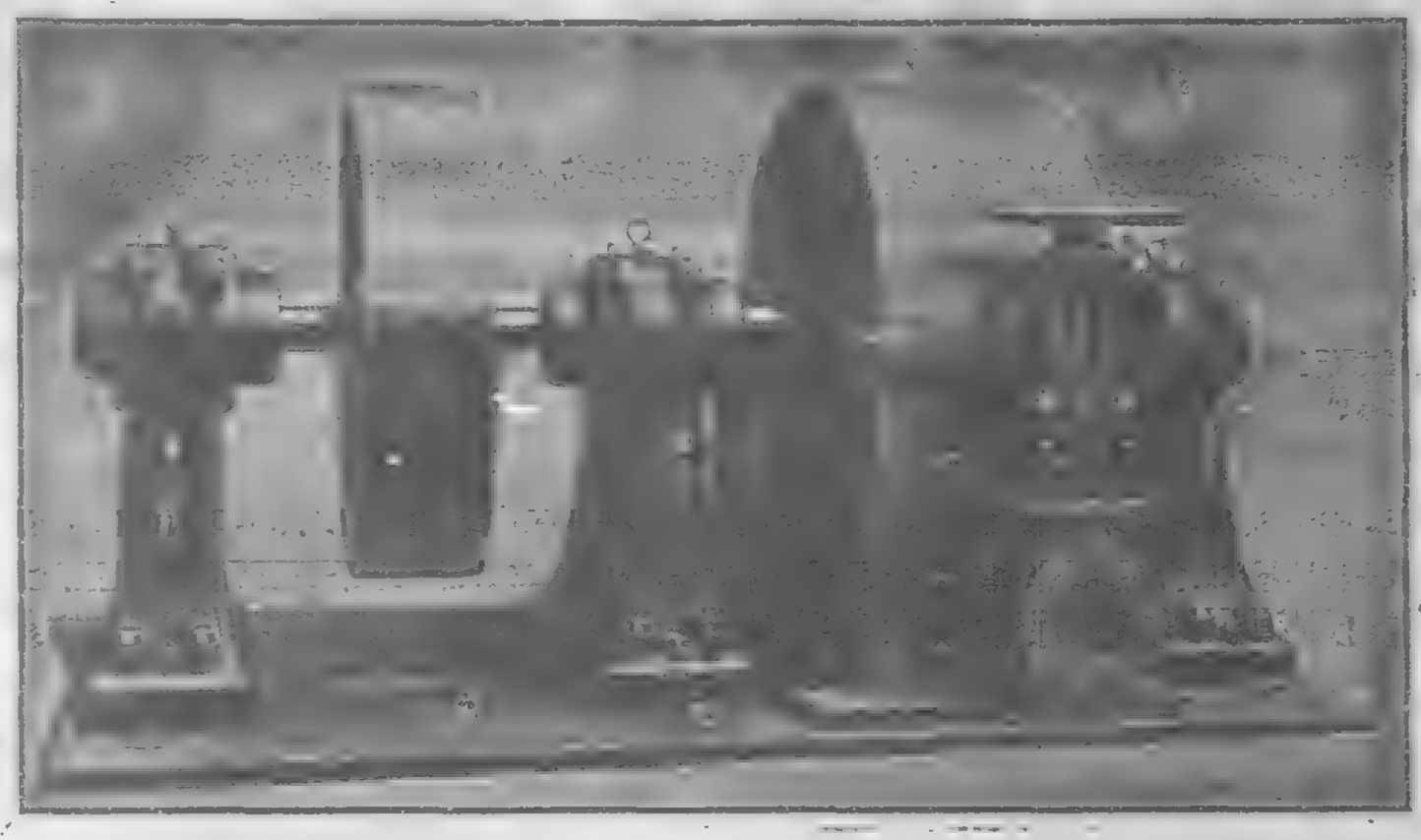
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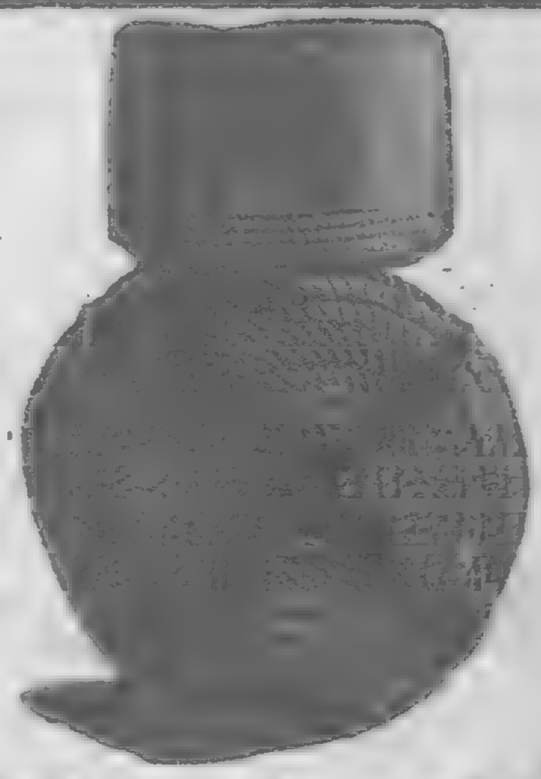
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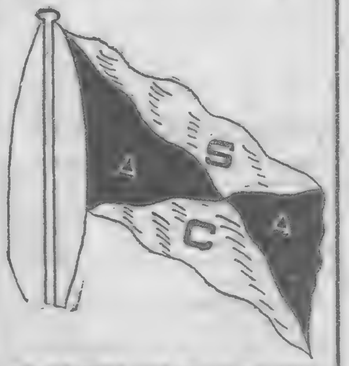
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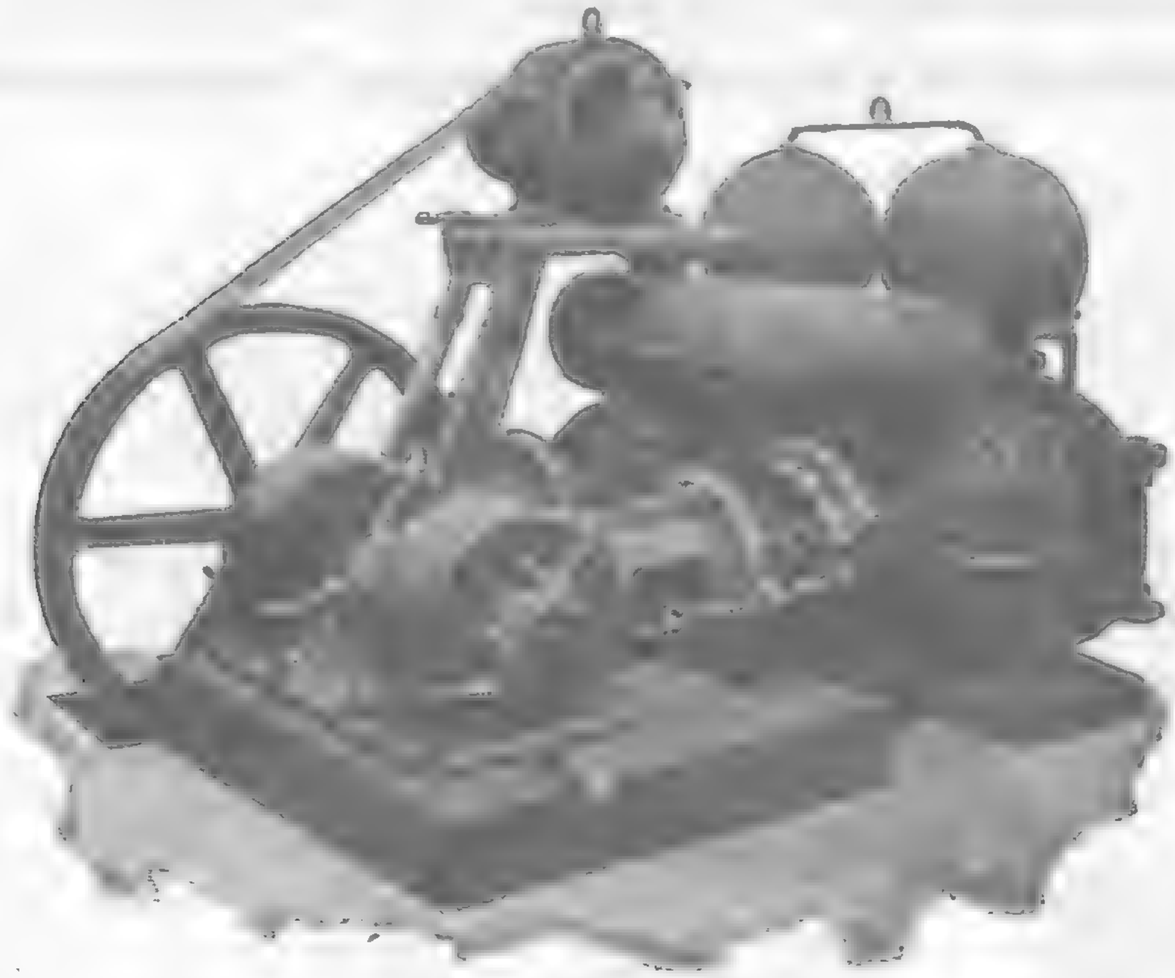
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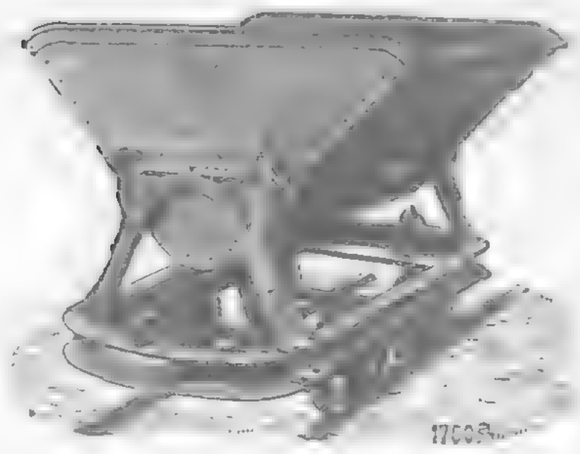
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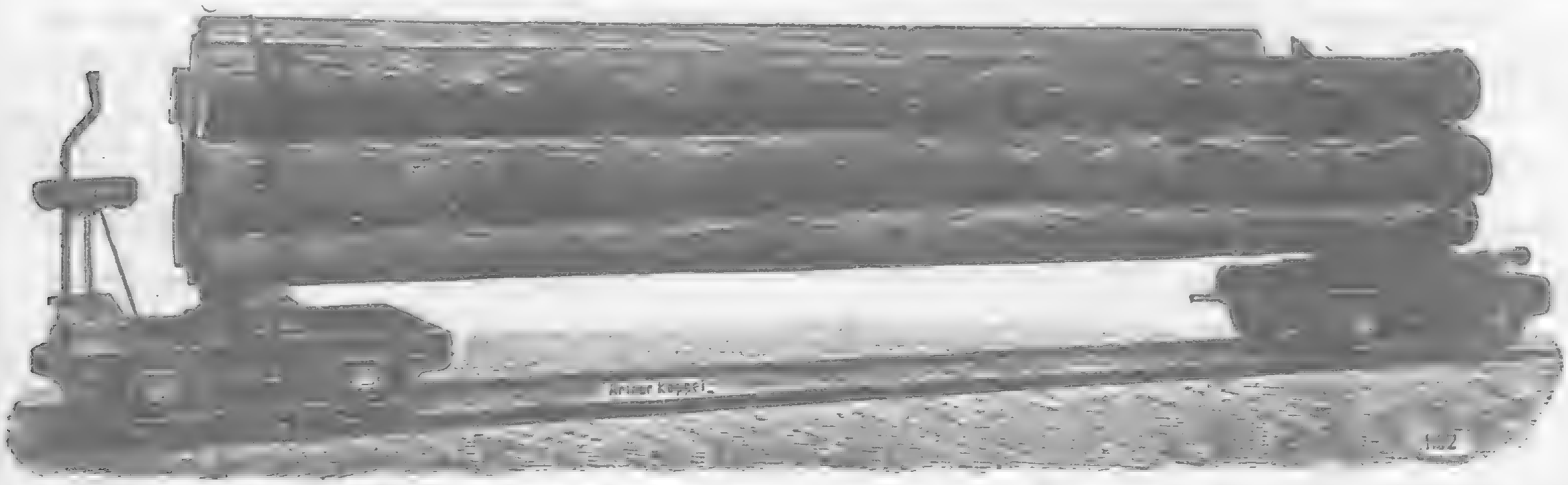
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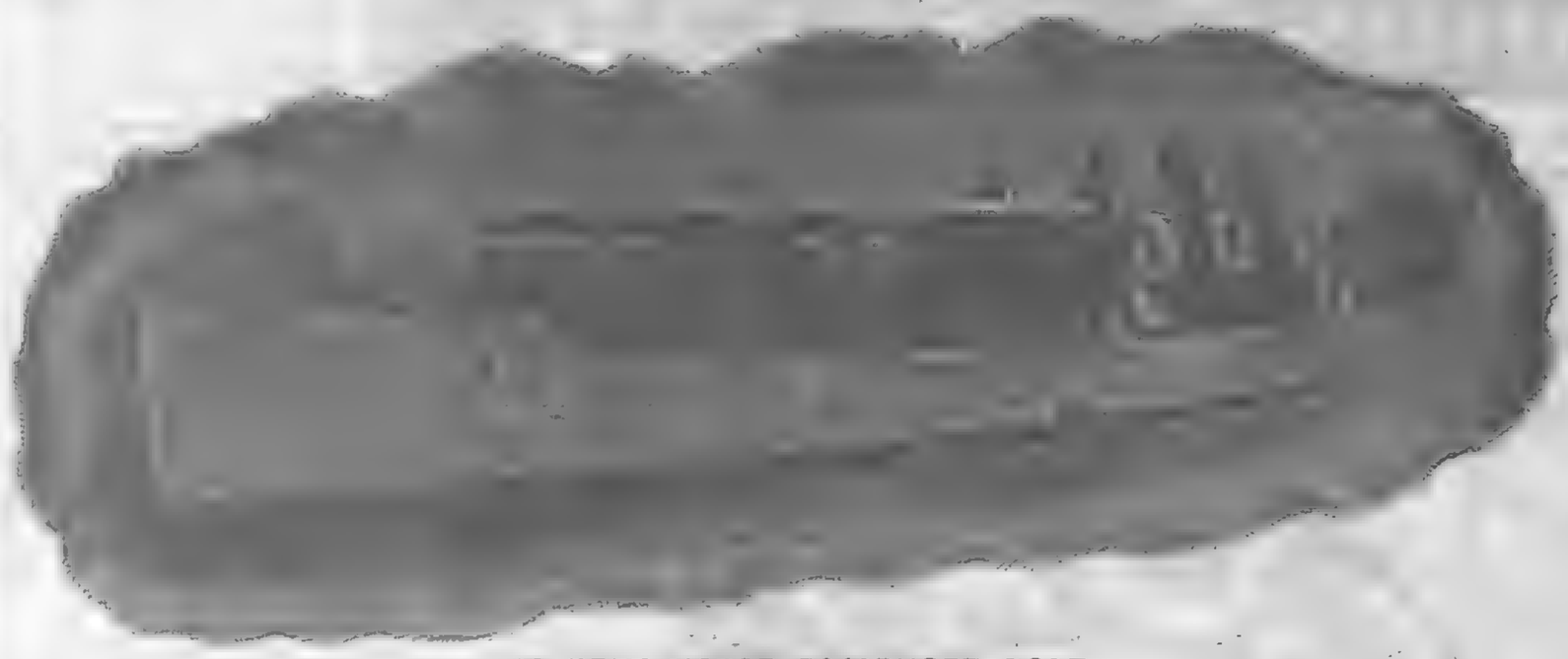
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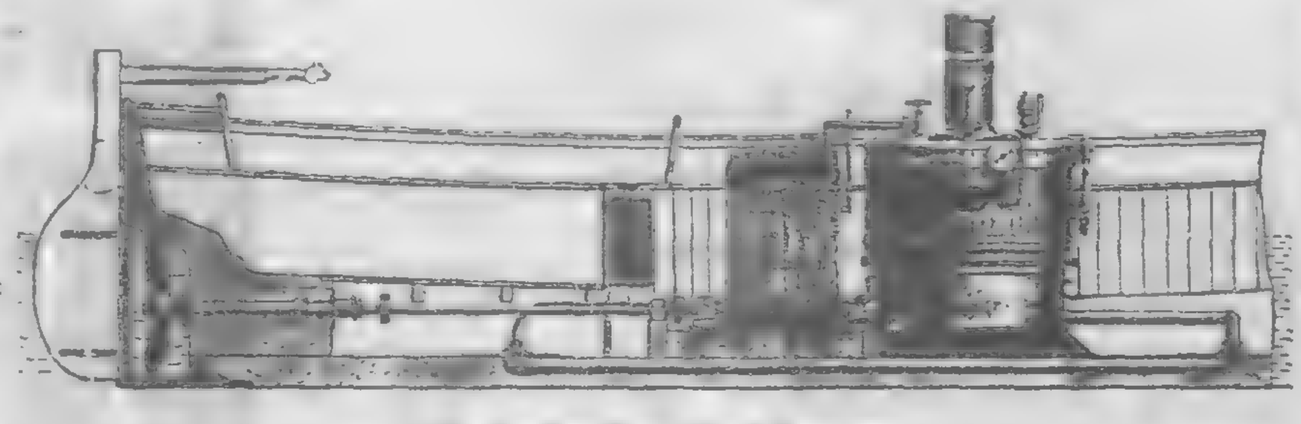
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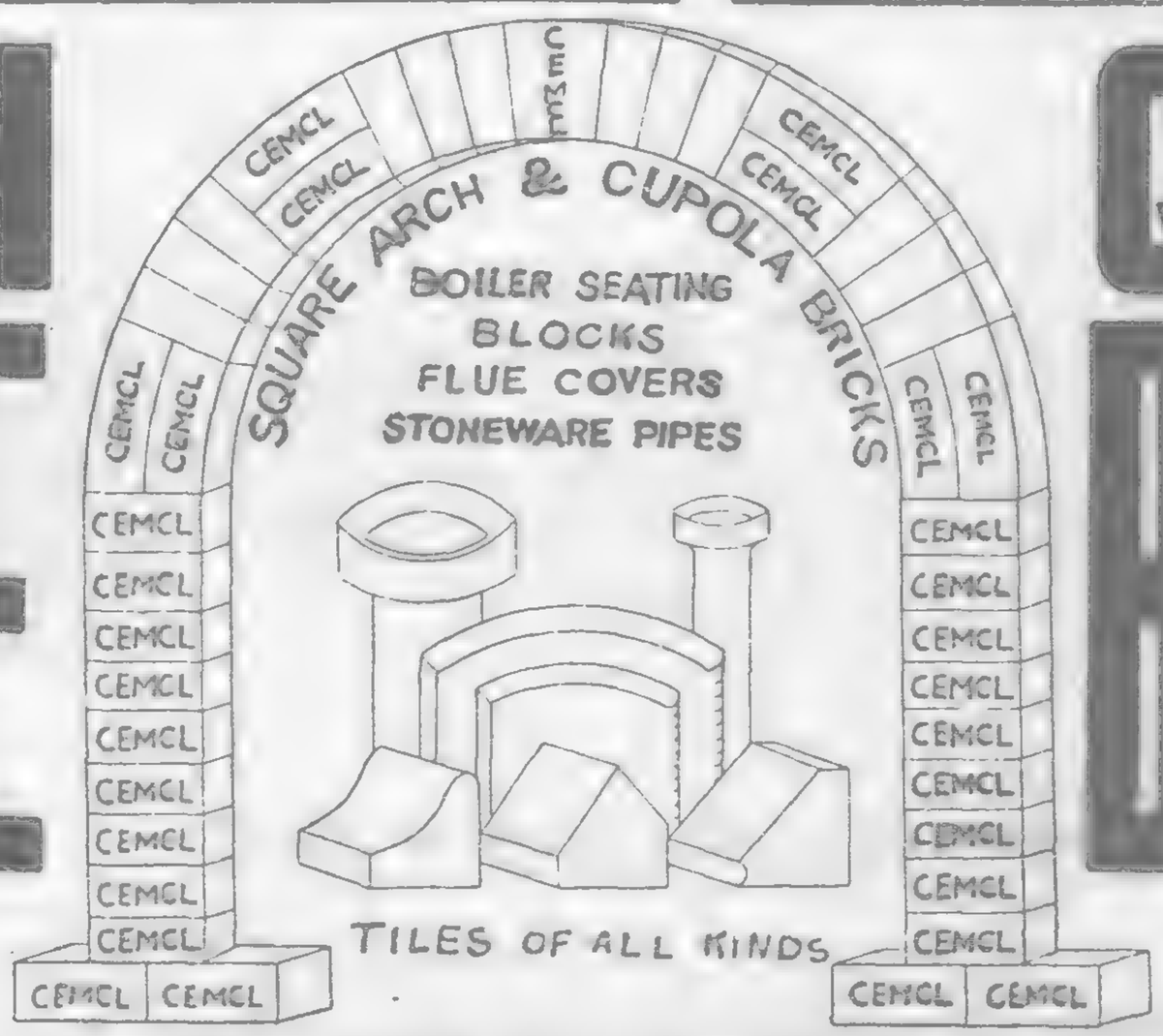
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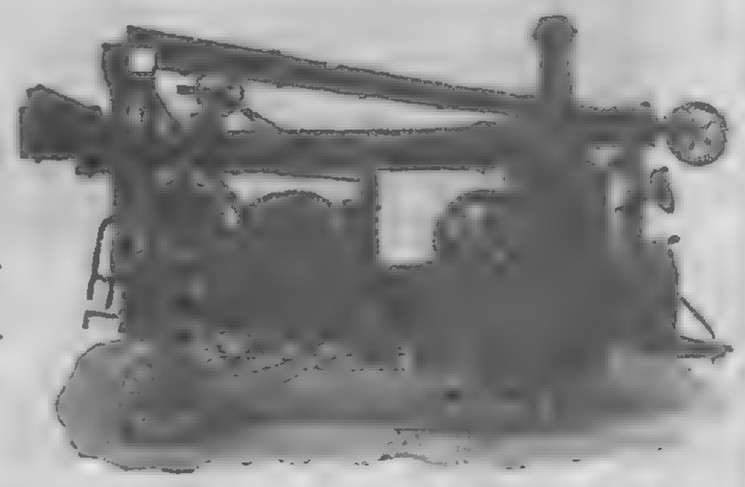
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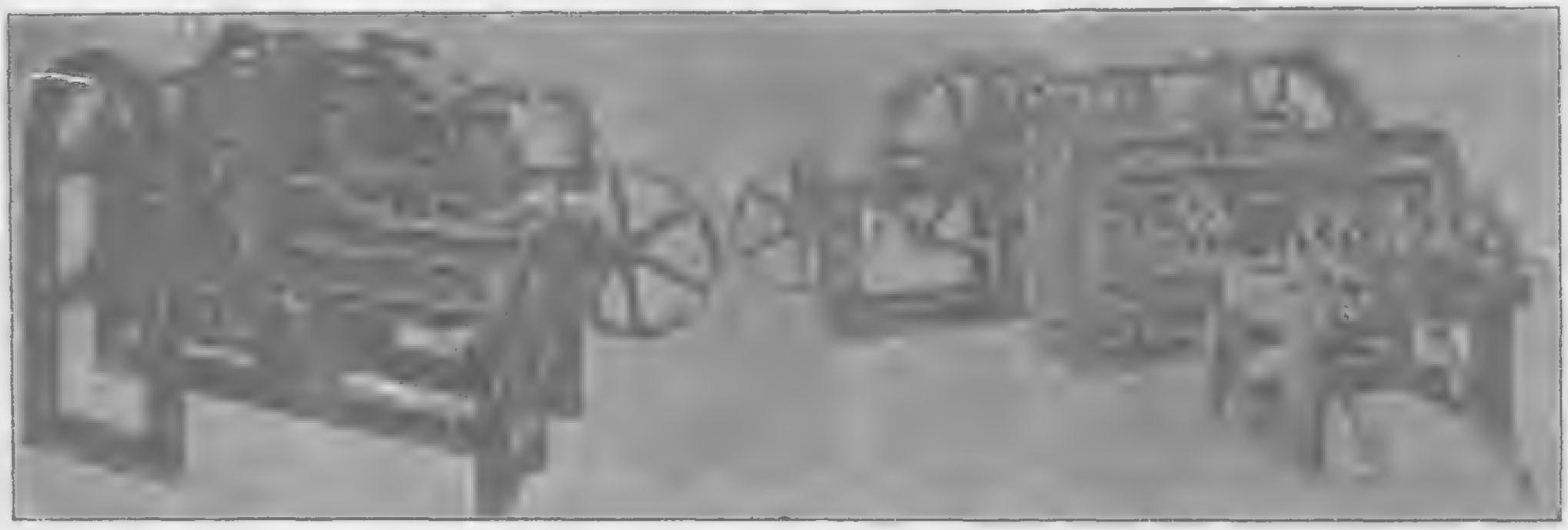
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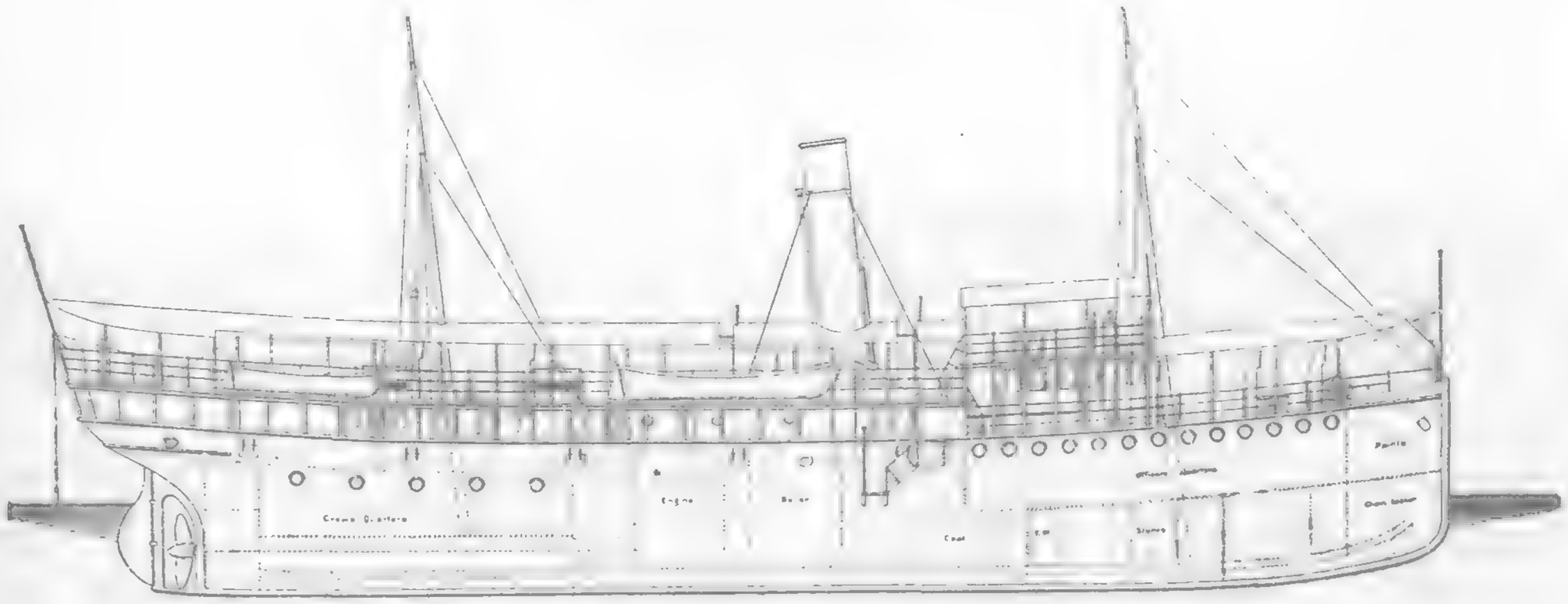
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				SPRINGS	NEAPS
KOWLOON	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
No. 1 Dock, Kowloon	575	86 feet top, 70 ft. bottom	30′	7′ 6″	3
No. 2 Dock, Kowloon	371	74′	18′ 6″	7′ 6″	—
No. 3 Dock, Kowloon	264	49′ 3″	14′	7′ 6″	—
Patent Slip, No. 1, Kowloon	240	60′	14′	7′ 6″	—
Patent Slip, No. 2, Kowloon	220	60′	12′	7′ 6″	—
TAI-KOK-TSUI					
Cosmopolitan Dock	466	85′ 6″	20′	7′ 6″	—
ARERDEEN					
Hope Dock	430	84′	23′	7′ 6″	—
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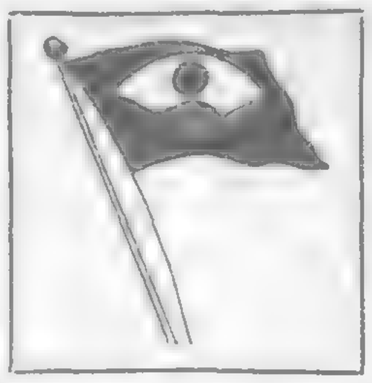
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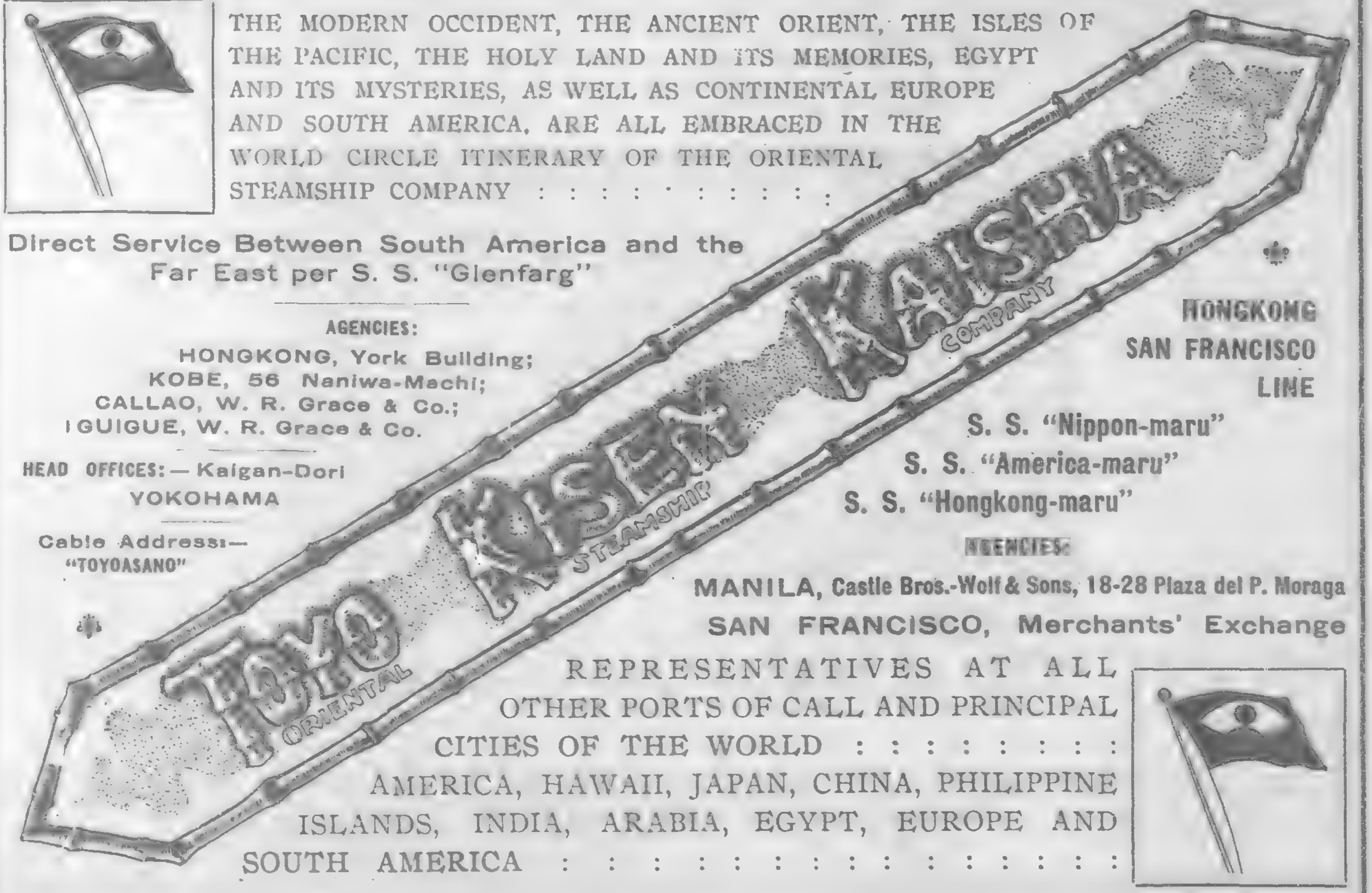
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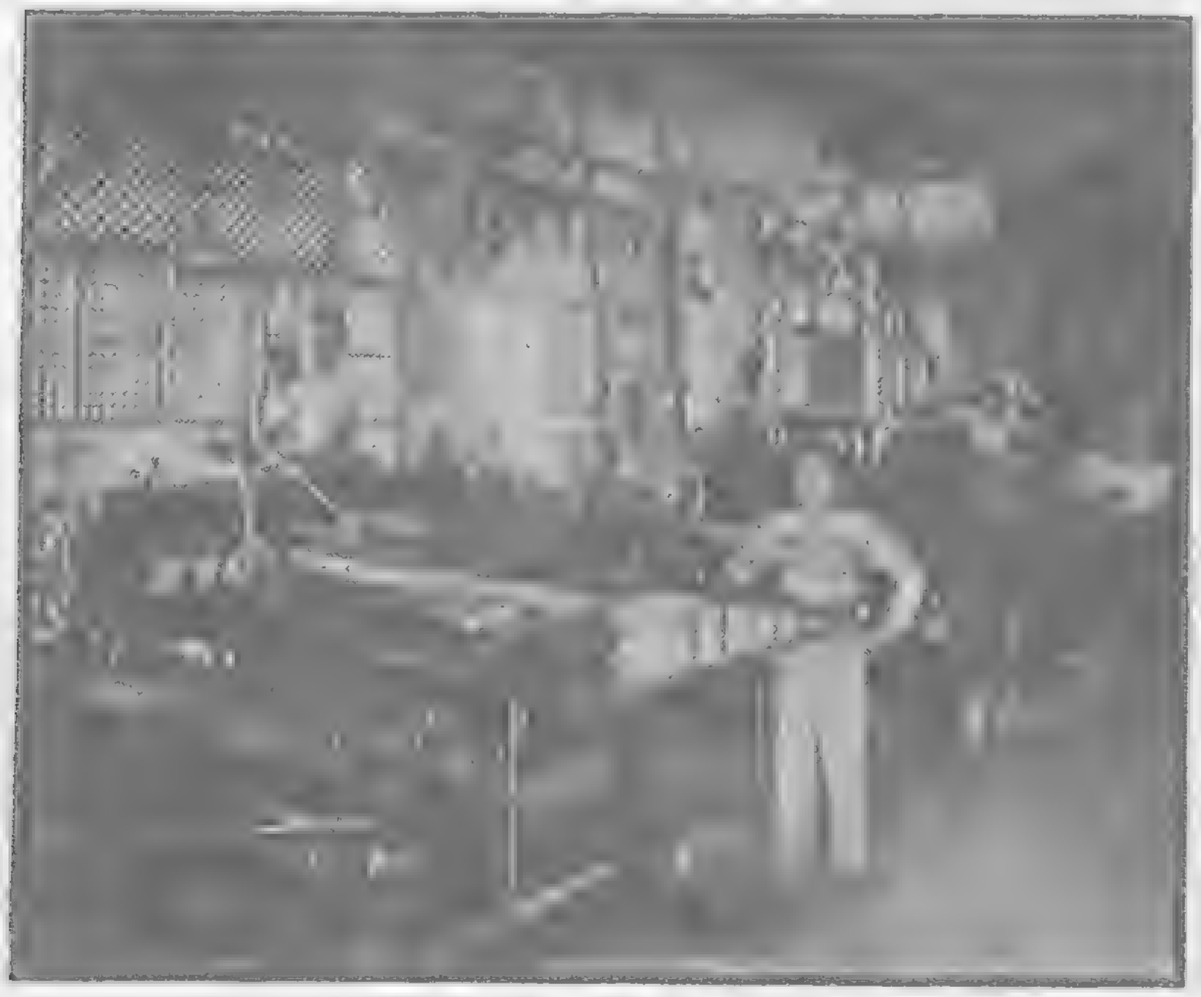


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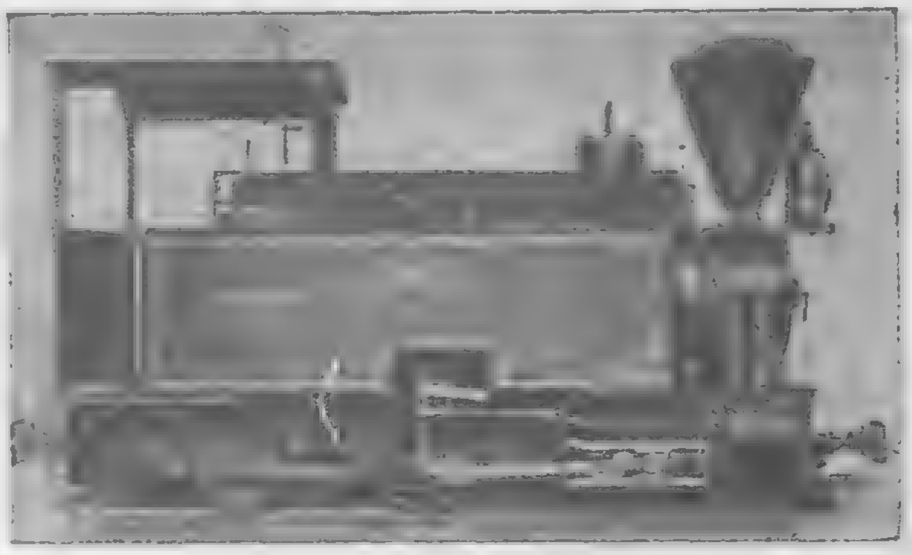
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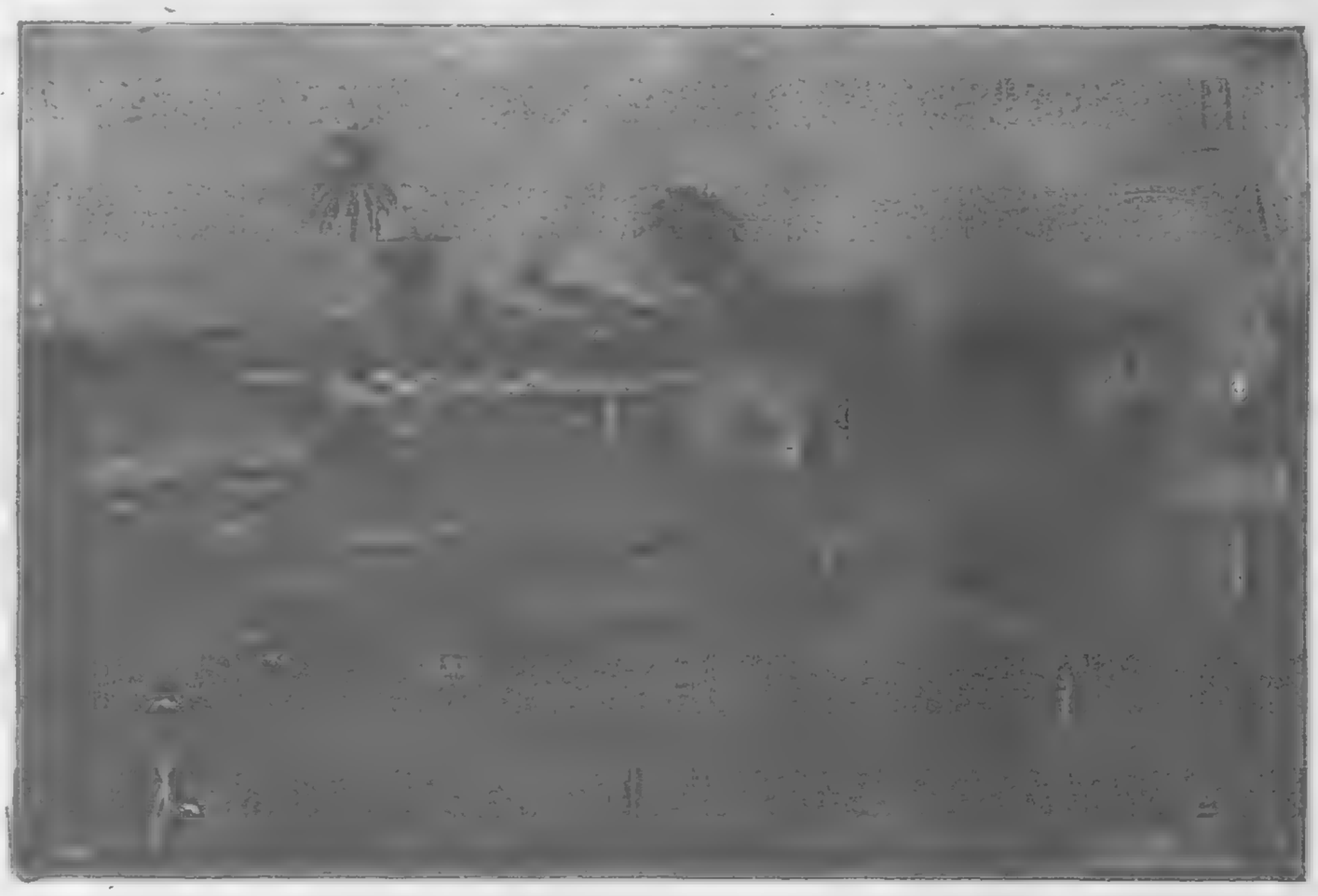
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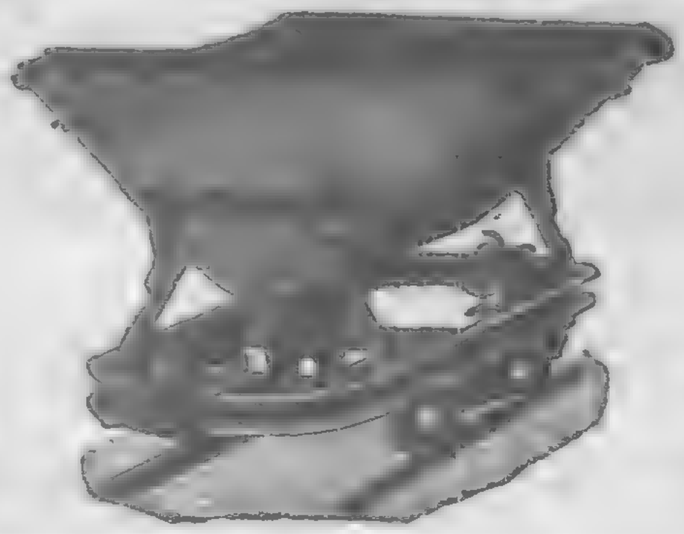
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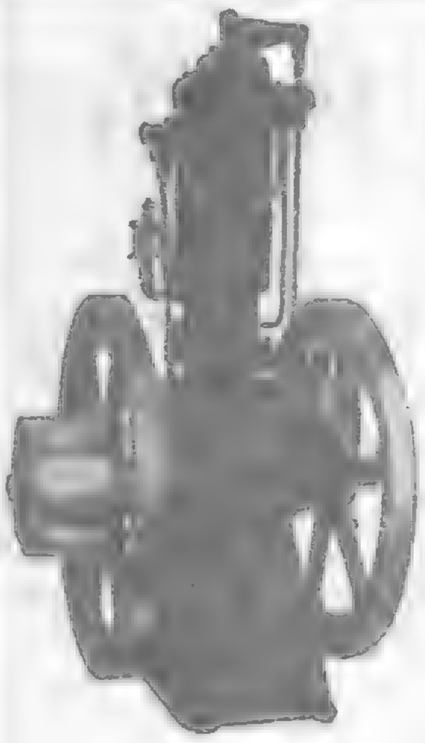


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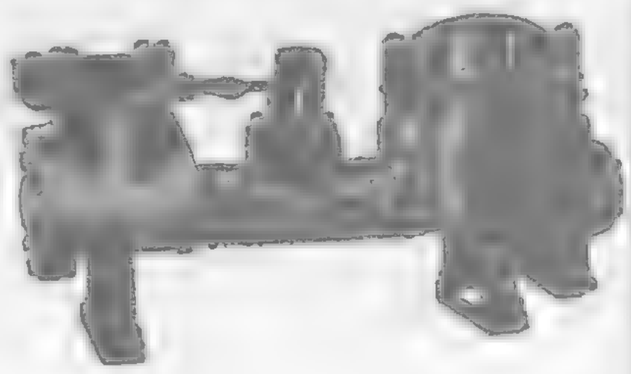








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THE FAR EASTERN REVIEW

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VOL. IV. MANILA, P. I., SHANGHAI, AND YOKOHAMA, JUNE, 1907. No. 1.

THE GEOLOGY AND MINERAL RESOURCES OF THE PHILIPPINE ISLANDS

By WARREN D. SMITH, Actg. Chief, Division of Mines; MAURICE GOODMAN, Mining Engineer.

Advance Notes from the Annual Bulletin issued by the Division of Mines at the end of the calendar year.

THE ROLE OF THE MINERAL INDUSTRY IN THE DEVELOPMENT OF THE PHILIPPINES.

INTRODUCTION.

In the history of any country its wealth has depended upon three factors; first, its agriculture; second, its minerals; and third, its transportation facilities. The first is more immediately connected with our existence, the second makes possible the greater development and distribution of the first and the third is vital to both. If we look at the history of the great state of California we see two great epochs clearly defined. Long before her rich valleys and fertile hillsides yielded up their wheat and honey and fruit her streams were being panned for the precious metal and her mountain sides tunnelled. After the first great wave of prospectors and miners beating against the Sierras, wrenching away vast quantities of riches, had subsided those who had but a short time before been absorbed in the pursuit of the yellow metal went quietly to work on the plains of the great Sacramento valley to engage in the quieter pursuits of agriculture California has done great things in agriculture and without a doubt what she has accomplished is due in great measure to the fact that she had capital to start with; and so it will be in the Philippines. The great difficulty in these Islands today is the lack of capital, and we dare say that had we a healthy and vigorous mining industry here turning out the various metals which can be turned into money, our agricultural problem would be a fairly simple one. If we stop to think of the ₱2,000,000.00 which leave these Islands every year to buy coal in a foreign land we see right away that this means practically that much loss, that much capital which is deprived of its ability to work (for us at least) towards producing more capital. In the working of the mineral industry of any country there are five parties or groups of parties engaged, namely: the prospector, the government, the private engineer, the promoter, and the capitalist, and all are absolutely necessary to the proper solution of its problems. We shall take these up in the order named, considering first the work of the prospector, for it is he who blazes the trail; he is the explorer, and as Kipling says, for him there is always "something lost behind the ranges."



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If anything of value is found the prospector is generally the one to find it, but in the history of mining he has rarely reaped the full reward of his labors. You have but to follow the subsequent history of the men who located the first claims on the great property of the Comstock Lode to see how much the world is indebted to these men, and how little of the great stakes they really drew. If the average man in his city office could go out into the wilds of the *bosque* and see some of these men in their tattered rags, with their handful of food, sometimes suffering from fever, deluged with rain, or risking their lives among half savage people on swollen rivers, and typhoon swept seas, he would have a greater respect for the pioneer who uncovers the wealth stored away in the rocks. Would it not be a saving investment if the government could subsidize a few of these well chosen men and make it possible for them to do more efficient work? In the Philippines we are absolutely dependent upon them, for the reason that the vast body of the native people know nothing of minerals and ores and until they can be educated along these lines we must depend upon that small but hardy band of Americans, and also some Europeans, who have chosen to leave the beaten track and search beyond the pale of cities and towns.

(Continued on page 4.)

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MANILA, SHANGHAI AND YOKOHAMA, JUNE 1907

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FOURTH VOLUME OF REVIEW

The June issue of the FAR EASTERN REVIEW is the initial number of the fourth volume. The success attained by the magazine as a representative journal of the FAR EAST devoted to the advancement of the commercial interests of eastern Asia is measured by the generous endorsement it has received at the hands of the captains of industry and the Press of the Orient. Every effort has been made to serve a large and growing clientèle so that no progressive section from India to Vladivostock has suffered from neglect. With increased facilities, the fourth volume of the REVIEW promises to eclipse all former ones in point of interest and value to all who are interested in the development of the East.

In this issue, the REVIEW devotes the greater portion of its space to the mineral wealth of the Philippine Islands. The subject is an exhaustive one. Heretofore little of a definite character was known as to the industry in the archipelago. An effort has been made to gather from every available source the most reliable data and for the first time it might be said that a complete and conservative review of the development of the mining industry of the Philippines is made available.

In connection with this departure the management proposes to take up in similar editions from time to time, the important industries of every section of the Orient. Never in the history of eastern Asia has the immediate prospect seemed brighter and the years 1907-1908 will surely be marked by great strides along the highway of progress, and it is the purpose of the REVIEW to keep well to the van in the onward march.

PHILIPPINE MINING PROSPECTS

Some one has defined a mine as a hole in the ground and the owner of the hole a distinguished member of the order of Ananias. The inference is that the owner of a mineral deposit will not cast any reflections on his property and is very prone to indulge in exaggeration when the merits of that same is being discussed. In this edition of the FAR EASTERN REVIEW every effort has been made to secure only the most reliable data without the slightest deference to the wishes of exploiters of the mineral wealth of the islands so that it may be said that no more desirable publication dealing with the subject has ever been given the public.

A review of the situation at the present time indicates that in at least one district gold has been taken out in paying quantities, giving most satisfactory returns for the capital invested. The development in this district has been slow but sure and every step taken carefully considered. For instance the Benguet Consolidated mines are increasing their output and under such favorable conditions that the shareholders of the company are satisfied that no outside capital is needed. Under similar conditions property in the immediate vicinity of the Consolidated is being developed with local capital. While there has been insufficient time to expect returns, all signs shall fail if the Bua company does not meet with equal success. It must be remembered that there is no bonanza in Benguet and those interested have proceeded with their work in fear and trembling until they were satisfied after years of effort that there was ore in sufficient quantities to warrant the installation of a plant. Their conservatism has been substantially rewarded, and it is worthy of remark that in all the successful development in Benguet province only local capital is interested. In view of the stringency of the money market in the Philippines this may be taken as an indication of the confidence of local capitalists in the development of the mineral industry.

In Masbate where indications are most favorable, the gold deposits have not been so successfully developed as in Benguet. This is due to lack of capital in some instances and poor business management in others. True the district is young and has not as yet been given sufficient time to uncover the hidden wealth. In justice to the enterprising miners who have invested their all and devoted several years of their lives to research and development work it is too early to render a verdict. Sufficient evidences of rich deposits have been found to warrant the expenditure of sufficient money to investigate the extent and quantity of ore available. Unfortunately the scarcity of local capital has been the greatest drawback to the proper development of the different properties. The older district of Benguet had the advantage of attracting the limited amount available and Masbate was forced to look elsewhere, and we are given to understand that one of these companies has met with success in New York. With sufficient capital and wise direction there is every indication that Masbate will prove one of the most important gold mining centers in the Philippines.

The development of the deposits of coal throughout the islands is interesting American capital, but the work has not yet progressed to a stage where any verdict may be rendered. The work is being watched with interest and experiments are being made with a view to utilizing the coal by the use of gas producing engines.

From a careful review of the different mineral deposits sufficient evidence of their commercial value appears to have been secured to warrant the expenditure of sufficient capital to complete investigations in the different zones. Philippine capital alone cannot undertake this task at this time, and it is our opinion that foreign or American capital could not be expended in any mining region with better prospect of favorable returns.

FRONTISPIECE

The illustration on the cover is the reproduction of a photograph of a forty-ounce bar of gold from the Benguet Consolidated Mining Co.'s property at Antimok.

PROPOSED AMENDMENTS TO PHILIPPINE MINING LAW

The following bill providing for several important amendments to the Philippine bill in regard to the mining laws provided thereby was introduced in the senate by Senator Lodge during the last session of congress. It was read twice and referred to the committee on the Philippines who failed to report it back to the house. Friends of the bill expect favorable consideration next session.

Section 33 of the Philippine Bill is proposed repealed by this bill and this is its most popular section. The original section as it now stands is the most serious obstacle in the way of the development of the mineral resources of the islands and reads:

"Section 33.—That no holder shall be entitled to hold in his, its, or their own name or in the name of any other person, corporation, or association more than one mineral claim on the same vein or lode."

Section 36 of the Philippines Bill was proposed amended to read:

"SEC. 36. That the United States Philippine Commission, or its successors, may make regulations, not in conflict with the provisions of this Act, governing the number of mining claims that any person, corporation, or association may locate on the same vein or lode, the location, manner of recording, and amount of work necessary to hold possession of a mining claim, subject to the following requirements:

"On each claim located after the passage of this Act, and until a patent has been issued therefor, not less than two hundred pesos' worth of labor shall be performed or improvements made during each year: *Provided*, That where a group of two or more contiguous lode or placer mining claims are held by any individual, corporation, or association the total value of the improvements or labor required upon such group may be made or performed upon any one of the group: *Provided further*, That any two claims in such a group have one boundary line in common, and that upon a failure to comply with these

COMMERCIAL ASPECTS OF MINING IN THE PHILIPPINE ISLANDS

By The Hon. W. CAMERON FORBES, Secretary of Commerce and Police.

There is little doubt that the mining industry of the Philippine Islands is destined to become a very important feature of their commercial development. At the present time the most tentative beginnings only have been made, and there is not an instance on record where the industry has been developed to a point where it can be dignified by classification among the important industries of the Philippines Islands. The indications are, however, that such beginnings as have been made will lead to important further development.

The gold mines of Benguet Province have begun to yield profits to the owners. All the other miners are patiently putting their money into the ground, making additional developments and prospects, and the results are reported to be such that the realization period, when the gold will begin to come out in comparatively large quantities, is apparently not far away. This should tend toward a very rapid development of Benguet Province.

The Masbate gold propositions are still in the development stage, but the owners of the properties there are confident that they also have something that will turn out very profitable.

In Lepanto-Bontoc the Igorots have, for many generations, been extracting copper from the ground, and the indications are that copper mines there should be profitable if worked on a large scale.

Gold and copper, however, are not the only minerals found in the Archipelago. There are other classes of mines which are just as profitable and as important: manganese has been found in one province; there are indications of oil in several sections; and the coal industry is one, the need of the development of which is paramount in the Philippine Islands.

There are coal veins of importance to be found in many of the Islands; notably in Cebu, where a company is busily at work at the present time developing. The reports of operations on this property indicate that satisfactory progress is being made. The military authorities are developing coal mines on Batan Island in the Province of Albay; and coal has been found on Polillo Island. There is also coal on Luzon Island proper, and various other parts of the Archipelago,

I do not attach as much importance to the necessity of coal for manufacturing purposes as I do to its importance to commerce from the view-point of shipping. I believe that water power can be developed in sufficient quantities, and within reasonable limits of expense, to care for the manufacturing necessities of the Islands and possibly for the land transportation. The Agno river of the Island of Luzon, the Agus river of the Island of Mindanao, and several others of which perhaps surveys have not yet been made, are capable of supplying ample power for all the needs of the country within the radius of their sites for a great many years to come. Not one, however, of these water powers has been developed, and the manufacturing business of the Islands is now being carried on by means of coal from Australia and Japan, and the ships plying in and about the Philippine Islands do so from motive power induced by foreign coal.

It is difficult to make the harbor of Manila an attractive one for sea-going vessels to visit. The seaport of Hongkong so near, where labor is so cheap, is our greatest handicap. To be sure we now have the harbor protected. In a short time we will have wharves built so that ships will be saved the expense and delay incident to lightering; but we have no satisfactory ship-building and repairing plant. Our laws are such, particularly in respect to tariff on imports, that sea-going vessels find it more advantageous to have their repair work done in Hongkong. It is difficult to say wherein the port of Manila could be made in any one point more desirable for the calling of vessels—compared with neighboring ports such as Shanghai, Hongkong and Singapore—than in the one item of coal.

If coal can be found here in large quantities and of suitable quality, and if it can be delivered in Manila at a lower price for the same unit of efficiency than it can be obtained at any of the other ports, we will have a thing which has been lacking in the past: one definite point wherein we can say to the shipping world, "In this we excel any of our neighbors."

To accomplish this it will be necessary to mine coal on a large scale and by improved methods, and to have improved transportation facilities and handling devices for putting coal aboard ship.

There would, of course, be the natural advantage that all the money now spent by the United States Army, by the Civil Government, by the merchant marine, and by the manufacturing plants in the Philippine Islands for coal for use in the shipping and manufacturing business would be expended in the Philippine Islands and not sent to develop the resources of Japan and Australia. The early commercial development of at least one of the big coal mines of this region is, therefore, of the greatest urgency, and it should be the duty of all of us in the Philippine Islands to endeavor to interest the necessary capital to accomplish such a result.

The Director of Navigation has recently been instructed by the Secretary of Commerce and Police, with the approval of the Governor-General, to so arrange the grates on some of his vessels as to give tests of Philippine coal, and ascertain the actual cash results therefrom, whenever and wherever it can be obtained.

The development of the mining industry, besides its advantage in increasing the trade of the merchants, both those who import mining machinery and tools and the purveyors for general use, gives a large advantage which no other industry presents, in that the romance attached to mining attracts a large population which would not otherwise be brought to the Philippine Islands. A movement such as came to California, to Alaska, to Colorado and other parts of the United States, would bring in a

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conditions the claim or mine upon which such failure occurred shall be open to relocation in the same manner as if no location of the same had ever been made: *And provided further*, That the original locators, their heirs, assigns, or legal representatives, have not resumed work upon the claim after failure and before such relocation. Upon the failure of any one of several coowners to contribute his proportion of the expenditures required thereby, the coowners who have performed the labor or made the improvements may, at the expiration of the year, give such delinquent coowners personal notice in writing or notice by publication in the newspaper published nearest the claim and in two newspapers published at Manila, one in the English language and the other in the Spanish language, to be designated by the chief of the Philippine insular bureau of public lands, for at least once a week for ninety days; and if at the expiration of ninety days after such notice in writing or by publication such delinquent shall fail or refuse to contribute his proportion of the expenditure required by this section, his interest in the claim shall become the property of his coowners who have made the required expenditures. The period within which the work required to be done annually on all unpatented mineral claims shall commence on the first day of January succeeding the date of location of such claim."

Section 56 is also amended to read as follows:

"SEC. 56. That the three preceding sections shall be held to authorize the holding of only one entry by the same person or association of persons, or by any association of persons, any member of which shall have taken the benefit of such sections either as an individual or as a member of any other association, and that persons claiming under section fifty-four shall be required to prove their respective rights and pay for the land filed upon within three years from the time prescribed for filing their respective claims, and upon failure to file the proper notice or to pay for the land within the required period the same shall be subject to entry by any other qualified applicant; and any person or association shall, after entering upon any quantity of vacant coal land as prescribed in the three preceding sections and before obtaining a patent for same, have the right to mine and sell coal therefrom: *Provided*, That upon the coal extracted before obtaining a patent a royalty of thirty centavos per ton shall be paid to the government of the Philippine Islands in such manner as may be directed by the governor-general thereof: *And provided*, That if a patent for said land is not secured within one year after the time prescribed for filing claims to said land a tax thereon of five pesos per hectare shall be paid into the Philippine treasury each succeeding year until a patent be secured: *Provided*, That in lieu thereof, that on each claim located after the passage of this Act, labor may be performed or improvements made equal in value to said tax, evidenced in such manner as may be prescribed by the Philippine Commission; and in the event of failure to comply with these conditions, that part of section thirty-six of this Act which is applicable upon the failure to comply with the conditions for holding a mining claim shall apply thereto, except that the period within which the work shall be required to be done annually on all unpatented coal claims shall commence one year from the date of location of such claim."

SEC. 4. That section seventy-five of the Act of Congress approved July first, nineteen hundred and two, entitled "An Act temporarily to provide for the administration of the affairs of civil government in the Philippine Islands, and for other purposes," is hereby amended by amending the second clause of said section so that the said section, as amended, shall read as follows:

"SEC. 75. That no corporation shall be authorized to conduct the business of buying and selling real estate or be permitted to hold or own real estate except such as may be reasonably necessary to enable it to carry out the purposes for which it is created, and every corporation authorized to engage in agriculture shall, by its charter, be restricted to the ownership and control of not to exceed one thousand and twenty-four hectares of land. And it shall be unlawful for any member of a corporation engaged in agriculture and for any corporation organized for any purpose except irrigation to be in any wise interested in any other corporation engaged in agriculture. Corporations, however, may loan funds upon real-estate security and purchase real estate when necessary for the collection of loans, but they shall dispose of real estate so obtained within five years after receiving the title. Corporations not organized in the Philippine Islands and doing business therein shall be bound by the provisions of this section so far as they are applicable."

SEC. 5. That, subject only to such limitations and regulations as may be provided for by the Philippine Commission or their successors to exempt navigation from artificial obstructions or to protect prior vested rights, all navigable waters and all shoal waters between low and mean high tide on shores, bays, and inlets of the Philippine Islands shall be subject to exploration and mining for gold and other precious metals by citizens of the United States or persons who have legally declared their intention to become such or of the Philippine Islands: *Provided*, That such exploration and mining shall be by virtue of licenses granted by the governor-general of said islands: *And provided further*, That no exclusive licenses for this purpose shall be granted except as to limited and prescribed areas under general regulations established by the Philippine Commission.

set of industrious, hardy, and progressive men who would form a unique society and aid in the development of land in parts which up to the time of their entrance had been almost inaccessible.

Not the least of the benefits derived from the development of mines is the development of transportation. One is reminded of the parable of the man who told his sons that gold had been hidden in a certain field, and that if they would dig sufficiently into that field they would discover it. The sons forthwith took their hoes and shovels and dug the field across from end to end and from side to side; but though they found no gold therein their crops increased four -fold and the gold came as the result. Thus, a road into the mining region, while it might not bring out metal, would probably bring out many times its value in wood, agricultural products, and other things.

In this way the development of the successful mine will mean the development of the successful railroad, which will infuse life into the region it penetrates as the heart pumps blood through the arteries, giving life and health to man.

THE GEOLOGY AND MINERAL RESOURCES OF THE PHILIPPINE ISLANDS

(Continued from page 1.)

THE GOVERNMENT

Second is the work of the government. Nearly every country of any standing among civilized nations maintains a corps of men whose business it is to be versed in the lore of geology and mining. These men are trained to act as guides, to keep a watchful eye on the prospector, to help make his path smoother, and to bring what he has found to the knowledge of the outside world. In many countries this corps of geologists and engineers is busy in making reports on mines already established and on a paying basis. But this, it seems, is rather a waste than a gain. The government in its work should anticipate rather than follow behind; it should make surveys over the public domain, mapping and defining the various formations, pointing out the probable localities and horizons of mineral richness, in short, doing a class of work that the prospector cannot do because of lack of training and for which the private engineer has not time. The private engineer's work lies in a restricted field, and he can cover this much more efficiently than the government engineer, whose work is of a broader nature. In the early stages of the work the government should carry on work of a reconnaisance nature and as time goes on this work may be brought down to greater and greater detail. Another way in which the government might materially aid in promoting the mineral industry is that of offering bounties and various other inducements for the discovery of valuable deposits. It might even grant pensions under certain conditions to men who have become worn-out in their struggle with Nature. The commonwealth of Australia is very far advanced in these matters and through her judiciously distributed bounties has done much for the benefit of all concerned.

We shall not take up much space here in a discussion of the mining laws, as they will be treated elsewhere and under a separate head in this paper. Naturally, in its mining regulations the government finds its most potent instrument for good or harm. Sometimes an overzealous government, in its efforts to prevent graft and monopoly, can so fetter legitimate persons and enterprises as to strangle the whole industry. This can be carried to such extremes as to become a grave economic mistake. It were far better to err on the side of leniency than stringency. The vital thing is to get something started and afterwards put on the check rein.

At last there appears a light on the horizon in the shape of a bill introduced in the senate of the United States providing for some vital changes, the passage of which we hope for at the next session of congress, and which will mean a new and more auspicious era.

THE PRIVATE ENGINEER

Third, having found the ore, it is the work of the private engineer to convince capitalists that it is worth while, and having convinced the capitalists, it is his business to extract the ore; and with his field of work so defined he naturally resents it if the government engineer comes in and makes a report on property to which he naturally has a right. The private engineer and the government engineer can supplement each other's labors very harmoniously and very profitably to both. The former while engaged in the exploitation of the property under his charge can find out many facts which if properly recorded can be, or will be, of great utility to the geologist in his field; and the government engineer can aid the other by furnishing him with the broader facts which help to elucidate the conditions in a smaller and limited district.

THE PROMOTER

Fourth, we come to the promoter. In this latter day we all naturally shy away from the mining promoter and oftentimes with good cause, but the mining promoter is a very necessary person. Someone must do the advertising, and with a proper inspection of mine prospectuses the many fake schemes could be eliminated without our losing that valuable functionary, the booster.

THE CAPITALIST

And last we come to the capitalist; he is the man with the means to accomplish things. Many people are accustomed to "take a fling" at the capitalist just because he is a capitalist and has more money than they and we sometimes think that the capitalist is a much abused person. It is his money (we presume it to be his) that is going to take the risk and naturally he has a right to know the truth and the whole truth about the property or scheme that he is asked to confide in. Today we have rigid examinations for admission to the bar; we have long and severe courses through which a man must go before he has a right to practice medicine on his fellow men; and yet we do not require an examination for admission to the bar of men in the mining profession, men who often bleed their brethren more deeply that the leeches of old time. If the government would require an examination or a certificate from a reputable mining school of every man who sets up to be a mining engineer it would prevent hundreds of people losing their savings, and greater trust and greater confidence would be instilled into the mining industry. Think what a deplorable state of mind exists among many people when a well-known lawyer, a man of profound wisdom and education, makes the remark in all faith that all mining is nothing but a fake and swindle, that more money goes into the ground than ever comes out. What must a man of just ordinary intelligence, a man who knows nothing of mines and minerals and little of business think in regard to the mineral industry? Is it any wonder that people either bury their dollars under the house, thereby removing capital, however small it may be, from its position to earn, or rush blindly into any scheme that may be proposed; both are detrimental to the legitimate industry.

THE WORK OF THE PAST

When the American people took over the Philippine Islands they found a very efficient mining bureau in many ways, but the standards of the American people, while not always better, are at least different from those from whom we inherited these Islands, and so a change was thought necessary. In the last few years geology has become practically a new science; whereas it was at one time a study of the cloister it is now an applied science and all the great mining companies employ a corps of trained geologists who work ahead of and with the engineers who extract the mineral wealth. Many advances have been made in this science, and it is in America perhaps that the greatest strides have been made.

The first work of the Mining Bureau under the American regime was carried on by Judge Burritt, a lieutenant in the 12th Cav., United States Volunteers. Judge Burritt is a lawyer familiar with mining law, but neither a trained engineer nor a geologist. It was his duty to take over the records of the Spanish Mining Bureau and rearrange them and translate them for the use of his fellow countrymen. This long and tedious work accomplished, and well accomplished, he resigned in favor of the man who was to take up the thread where



DR. PAUL C. FREER, DIRECTOR OF THE PHILIPPINE BUREAU OF SCIENCE, WHO IS EVER READY TO ENCOURAGE THE PHILIPPINE MINING MAN.

he dropped it. This man was Mr. H. D. McCaskey, a trained mining engineer from one of the best mining schools in America. Mr. McCaskey's task was that of reorganization, and the mapping out of the technical work of the future. To this work Mr. McCaskey gave six years, the best years of his manhood. He had a big task before him, so big that the results of his labors may not be seen today or next year, even for many years. He did not demand credit for himself—so his work was done well he was satisfied; and finally, after six years, he returned to his home in the United States with his health badly impaired by his long, earnest, and trying labors in the Tropics.

The work of the present must necessarily be reconnaissance in nature, and should be an era of search, research and discovery. Accuracy of detail must be sacrificed to quantity and rapidity. We do not need to exercise supervision over mines when there are scarcely any mines at all; we cannot stop to develop properties—that is the work of the promoter and the capitalist; we must make broad and far reaching surveys, delimit the grander formations and point the way to the prospector.

When something has been found and capital has come in to develop it, then it will be our task to concentrate our work on individual mining fields, to provide regulations for the care of miners and other laborers connected with mines, to protect the public from false statements and keep a record of production.

TOPOGRAPHICAL SURVEY

The great and crying need for the work of the geologist, engineer, and operator is an accurate topographical map of the public domain on the general plan of the U. S. Geological Survey topographic maps. We need not dwell on the merits of such a map now. They are apparent to those who have done any engineering work.

A large amount of work is being done at this time by the several bureaus of the Philippine government, but we do not exaggerate when we say that fully two-thirds of the present map work being executed will be valueless in the future. A topographic map should be made by a topographer and not by just any one who happens to know how to use a transit. Perhaps we are doing the best we can, but the waste of time, energy, and money could be obviated with greater cooperation and uniformity.

Such an undertaking would require an immense expenditure of money and could hardly be borne in its entirety by the insular government. Possibly aid could be secured from the federal government. If the administration wants to do something that will be of lasting benefit to the Philippine Islands this offers opportunity. Prominent scientific and technical men in the United States have suggested this course—in fact it was Mr. McCaskey's great dream. Perhaps we are dreaming now but nevertheless we shall never cease hoping.

SOME FACTS THAT MILITATE AGAINST THE MINING INDUSTRY

In the interest of the welfare of the mining industry of the Philippines, the Mining Division wishes to impress upon the minds of the fraternity the desirability of conservative advertising. It were better for a new mining district to have to wait, however impatiently, until its resources are finally appreciated than to attempt to force matters through statements that are misleading or false.

Unfortunately, in our opinion there is no specific law in the Philippines bearing upon this subject. Several states in the United States have recently followed the example of the California state legislature, which body passed an act in 1905 deeming it a felony, should any officer of a corporation transacting business in that state, assent to the publication of any false or wilfully exaggerated report or prospectus of his company.

A fake prospectus must eventually be proved a fake and the particular camp it is booming, irrespective of its true merits, then receive a set-back from which it may be long in recovering. This has been proved time and again in our own West, where several mining camps eventually proved their worth in spite of, rather than as a result of, the misguided rantings of the boomer. Not that legitimate advertising and honest promotion is discredited, for frequently they are the only means available to bring the value of a prospect or mine to the attention of those having capital to invest Our intention is rather to counsel the bona fide prospector and miner against printing exaggerated or misleading reports and prospectuses. Already there prevails in the minds of only too many men, otherwise reasonable and intelligent, the impression that all mining is a fraud devised to swindle innocent widows and orphans and perhaps even business men. As a matter of fact no business can be fairer or cleaner than legitimate mining, honestly conducted. Particularly is this true of gold mining where the market of the product remains independent of any possible trust combination or competition.

There are other men who declare mining a gamble, and these come nearer the truth, although not so close as they imagine. Mining and metallurgy have become far more exact sciences than could ever be claimed for them in the past, and an estimate of the true value of a mining property which has been properly opened up and developed may be obtained by a competent mining engineer with a far greater degree of accuracy than the uninitiated may suspect; for all that however, there is a sufficient element of uncertainty connected with mining operations to warrant the assertion that all mining more or less is a gamble. A wise precaution on the part of the prospective investor, therefore, should be



PANORAMA OF THE BENGUET GOLD COUNTRY.



SCENE ON THE PARACALE RIVER, CAMARINE, SHOWING FIRST GOLD DREDGE USED IN THE PHILIPPINES.

to see to it that the odds he is getting are at least as good as he could expect in any other business enterprise. Where the chances are great, the possible returns from a comparatively small investment should be proportionately large. Having taken all reasonable precautions, should the venture prove a failure he will then have no cause for self reproach. A man who puts his money into a so-called mining enterprise merely on the strength of a gaudy prospectus or an alluring advertisement, invites disaster and should not put the blame of his loss on the innocent profession of mining. A man who has an important legal suit on his hands will in nearly all instances depend upon competent legal advice to win his suit, but in the business of mining, although the money involved may be far greater, he usually depends entirely upon his own limited knowledge of the profession or upon that of a so-called practical man, or in fact upon any one who can be accused of possessing that vague asset of common horse sense, the lack of which strangely enough, no man will admit.

A very common cause of failure, particularly of young mines that are managed by practical men, is the premature purchase and installation of mining machinery. Not only may the machinery purchased be ill adapted to treat the bulk of the ore to be extracted from the mine in the future, but the mill site chosen before the plans of development are finally decided upon may frequently be badly located to permit of economy in the transportation of the ore between the mine and the mill. But worst of all is to find oneself with a more or less complete plant with no ore to work. In nearly all cases this can be attributed to short-sightedness on the part of the managers and owners who, desirous of making a good showing to facilitate the selling of stock in the mine, have invested their limited capital in machinery rather than in prospecting and development The result usually is, more or less stock sold, a small amount of ore either on the dump or from near the surface worked out, and then all the machinery stopped. Another failure is then recorded and the brunt of it to a large extent falls upon the other mines and prospects in the district. The cases suggested above, while hypothetical to some extent, have all played their part in the history of mining in the Philippines and it is to caution the miner and small investor that they are here recorded.

GEOLOGY

Having now stated some general principles or some general factors which influence the mining industry, and having stated the policy of the Mining Bureau of the past, of the present, and what it is to be in the future, we shall give a general summary of our present knowledge of Philippine geology.

First we quote at length from Mr. G. F. Becker, the first American geologist to visit the Philippine Islands for the purpose of geological investigation, but who necessarily had to depend largely upon information from the Spanish engineers. Dana so long ago as 1833 visited the Islands as a member of the Wilkes' expedition, but he was largely engaged in an investigation of corals and coral islands. Mr. Becker wrote as follows:

"From early paleozoic times onward an archipelago has usually marked the position of these islands. Prior to the Eocene nothing definite is known of them, but further investigation will very likely disclose Paleozoic and Mesozoic strata there, as in the Sunda and Banda islands. During the Eocene it is probable that the lignitic series of Cebu were deposited, and the contorted indurated strata which in other localities also carry black lignite relatively free from water, should be referred provisionally to this period. Whether the nummulitic limestone found at Binañgonan is Eocene seems to me to be an unsolved question. After the Cebuan lignitic epoch a great uplift and folding took place, and this may have been a detail of the late Eocene movement that so profoundly modified Asia and Europe. It must have brought about temporary continuity of land area between Borneo and Luzon. Somewhere about the middle of the Miocene the country sank to a low level. Many of the present islands must then have been far below water, while Luzon and Mindanao were represented by groups of islets. Observations appear to suggest that the Agno beds represent the basal conglomerate formed at this subsidence. A slow rise began again during the later Miocene, and may have continued to the present day without inversion, yet the actual distribution of living forms is such as to give some grounds for believing that at some intermediate period the islands were a little higher than they now are, but sank again only to rise afresh. The diorites and associated massive rocks including their tuffs may have made their appearance about the close of the Paleozoic. The less siliceous of these rocks seem to have followed the more siliceous intrusions as a whole. The gold deposits, and perhaps other ores, are so associated with these massive rocks as to indicate a genetic relation. The neo-volcanic period began as early as the highest Miocene horizon, and very probably at the post-Eocene upheaval. If the semiplastic marls of Cebu are all Miocene, the earlier andesite rocks, at least, date back nearly to the great upheaval. Among these rocks, also, there is sometimes a tendency for the basalts to follow the andesites, but the one dacite found at Corregidor is later than the andesites of that island. The relation of the trachytes to the andesites is not certain but the sanidine rock is probably the earlier. A very large part of the neo-volcanic ejecta has fallen into water and been rearranged as tuffaceous plains. The volcanic vents appear to me to occur rather on a network of fissures than on a single system of parallel diaclases and the volcanic activity is to be regarded as a thermal manifestation of the energy of the upheaval."



NATIVES WASHING FOR GOLD ON THE PARACALE RIVER, CAMARINES.

In all essentials Mr. Becker is entirely correct; however, one or two corrections are necessary. The "nummulitic limestone" is an orbitoidal limestone and should be referred to the Miocene and not to the Eocene. In all the years since 1898, the time of Mr. Becker's visit, diligent search has not revealed any formation older, or known to be older, than Eocene and, in fact, we cannot absolutely state that the coal measures are even as old as the Eocene, though there is every probability that they are. It is possible, then, when sections have been made, either by traversing deep cañons through the Cordillera of Mindanao and Paragua or by deep shafting and tunnelling, older sediments may be found, though the chances are that they have long since been metamorphosed into schists or other metamorphics so that any organic remains that they may have contained would now be beyond recognition.

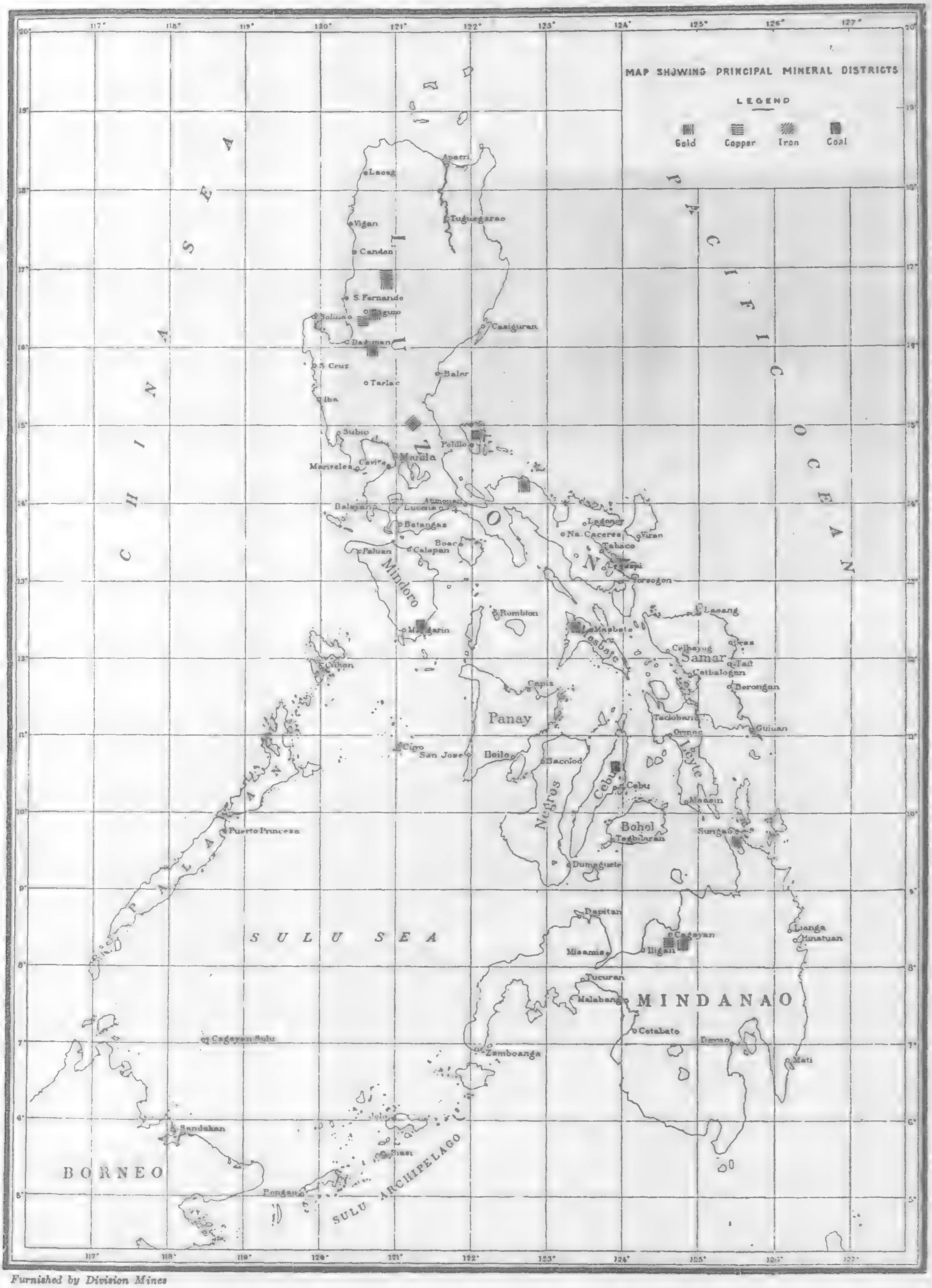


Permission Bureau of Mines.

ENRIQUE ABELLA COAL TUNNEL ON MOUNT LICOS COMPOSTELA, CEBU.

Two questions are often asked by people interested in mining and mineralogy. One is: "Is not our coal the same as that of Japan, and is not our geology the same?" To both parts

(Continued on page 8.)



Furnished by Division Mines

PHILIPPINE TIMBER FOR MINING OPERATIONS

Timber and water, so desirable in the development of the mining industry of any country, may be said to be plentiful in every mining district of the Philippines. In commenting on the timber available in the different mining regions Major Ahern, director of the Philippine Bureau of Forestry, says:

"The timber most available for mining purposes in the province of Benguet is the Benguet pine which is found in fair quantities. The sapwood of Benguet pine rots easily in contact with the ground, and stumps of young trees disappear in three or four years. The heartwood, however, lasts fairly well in the ground,



A SHAFT IN CLARKE'S MINE, BENGUET.

"Many valuable native woods are to be found in the region of Angat, Bulacan. On the front range of hills where the iron mines occur the forest is not so good as on the higher hills of that district.

"On the islands of Polillo and Batan where coal occurs there is plenty of mining timber, and these regions have never been exploited to any great extent.

and when very resinous is practically indestructible by fungi. The resinous hearts of the old pine trees are used by the natives for heavy corner posts of their homes. Benguet pine can also be found in fair quantities in the province of Lepanto-Bontoc, but no examination has been made as to the exact amount available.

"Assuming that all commercial timbers in the islands are equally available, the following timbers could be classed as the most durable for mining purposes:

"Ipil, Molave, Sasalit, Betis, Dungon, Yacal, Tindalo, Aranga and Bacauan. Perhaps the most accessible and abundant wood not far from the coast is that known as Bacauan. This includes several different woods found in the salt water swamps. Besides the woods referred to are many whose durability is as yet unknown and may prove of value."

The following notes are extracted from the Report on Forest Conditions in the Mining Region of Aroroy, Masbate, by Forester H. N. Whitford:—

"February 21, 1907.

"In all instances, the mines in this region are located in commercial forests. Where these mines are situated well up the slopes, they are within easy reach of the ridge type of forest, in which valuable first group woods are found. Where they are situated in the lower slope type of forest, the most accessible timbers are of the cheaper grade. All the timbers that have been cut up to the present time are within easy reach of the tunnels in which they are placed. In one mine, Tamayuan is being used extensively for props and footings. The trees selected are usually about 8 to 12 inches in diameter. Before placing they are barked, but so far as observed no attempt has been made to remove sapwood. Indeed, the tree, when mature, is seldom as large as 15 inches in diameter, so that the removal of the sapwood would, in many instances, leave the log too small for use. In this mine, young trees of all timbers in the vicinity are used for siding, especially Lauan, probably because it is most abundant. In one other mine, no attempt has been made to select timbers for props and footings, all being used indiscriminately and placed at once after cutting in the mines without barking.

"The cuttings in the vicinity of the mines are not extensive. With development, however, the demand for timber will be increased. It is to the interest of the companies to utilize the timbers to the best advantage, for if they do not do so, they will soon destroy the forest within easy reach. The custom of removing only small timbers is against all principles of silvicultural management. It means the destruction of a crop that should be left for future

THE GEOLOGY AND MINERAL RESOURCES OF THE PHILIPPINE ISLANDS

(Continued from page 6.)

of which the answer is no. In Japan a vast series of formations between the Eocene and the Archean are represented which we do not have, or, rather, have not yet found in our record; and in Japan they obtain coal from these different horizons, one of which is the Carboniferous, or the same as that in which the Pennsylvania coal of the United States occurs. The second question is: "Are there not to be found in Mindanao tin and diamonds?" Tin in most places in the world is associated with granitic rocks, greissen and granite gneisses. Up to the present time these rocks have not been encountered, save in one instance, in Mindanao, and to a limited extent in the northern part of Luzon. Not long since, an unscrupulous fakir from Mindanao reported tin in the vicinity of Cagayan, but on investigation it was found that the tin came from Australia and not from these Islands at all. Some have the idea that diamonds are to be found in Mindanao because they have been found in Borneo, but the diamonds come from the southwestern and northwestern part, while none have been found so far in that portion of the island nearest Mindanao, and the portion nearest Mindanao is geologically very much the same as the southwestern part of that island.

There seems to be a great deal of doubt in the minds of many people regarding valuable minerals in these Islands, but the pessimism is generally expressed by people who are willing to be satisfied with chance information and gossip and who really want the answer in the negative before they ask it. The output of gold in the island of Formosa during the last year amounted to over a million dollars. Now we know that the geology of Luzon and Formosa is not essentially different. We also know that conditions in the interior of Formosa are much less conducive to safe and rigorous prospecting and mining than in northern Luzon. There is gold in northern Luzon.

As yet we know of no bonanzas, but there are many properties which contain a large amount of low grade ore which would amply repay (and in one case *is* paying) the man or men who will have the patience and exercise the proper management. Only within the last few days has telluride ore been positively identified in a sample sent down from the Lepanto region. In Masbate we have several properties which have been examined by competent men and proved to be distinctly worth while. In the Angat region there are known to exist great bodies of hematite of bessemer grade which, as soon as a coking coal can be found or shipped in here, at reasonable prices, will prove an immense asset to the economies of the Philippines. In Lepanto Bontoc private and government surveys have shown to exist an enormous body of copper ore, but which up to the present time has been neglected owing to the one great obstacle, transportation. A company composed of influential and trusted men of the city of Manila has lately been formed and applied for a franchise to build a road connecting this field with the coast.

After many years of stormy criticism articles are appearing in the daily papers justifying the Benguet Road, but it seems that the one great reason for its justification is omitted. It is a matter of individual concern only that our public officials have a place to go to spend the hot summer months; but it is a matter vital to the general weal of the whole Philippine Islands that there is a means provided for hauling into the interior stamp mills and cyanide plants and other heavy machinery. This is the real justification of the Benguet Road, and, neglecting for the moment the question of cost, the building of the Benguet Road will probably be considered one of the wisest acts performed by our Philippine Commission in its whole period of service, and the sooner we build more of these roads, the better.

After long years of waiting we have seen another and definite start made in the exploitation of the coal of the Philippine Islands. One company has been organized, has been carrying on development work for a matter of six months or more, has procured machinery and built a tram road, and promises soon to have its coal on the dock in Cebu. Other capitalists have experts examining various fields and from their method of procedure and from what we know of the men involved, if the coal justifies any expense at all it will be properly and speedily placed at the disposal of consumers. In at least two localities in the Islands there exist the raw materials for the making of cement, and a capitalist has asked for a franchise to operate a plant erected according to modern ideas. It is our sincere hope that neither the government nor the people of the Philippine Islands will place any obstacles in the way of the man who proposes to carry out such an undertaking.

use. The mature crop should be cut first. For Molave and other first group timber, the minimum diameter limit should be fixed at 50 cm. While the cutting and preparation of large timbers may entail extra expense that the companies are not now prepared to meet, yet as soon as they are on a firm financial basis, such timber should be utilized. With the power that is necessary to operate stamping mills, etc., they could easily, and with little expense, install a sawmill, which would enable them to handle the larger trees, the waste of which could be utilized for fuel. Such a step taken now would mean great saving in the future. The history of all mining regions shows this.

"Timbers are necessary for two general classes of construction, viz: temporary and permanent. Many temporary tunnels are run in the development of the mines. These can be timbered with the cheaper woods, among which are Lauan and Toog. If such tunnels prove to be permanent, the timbers can be replaced. Of course Molave is the most durable, and it could be used for footings and posts. The supply of Molave is limited, however, and unless it is utilized with the greatest care, it will soon be exhausted. The same can be said for the other first and second group timbers, such as Narra, Tindalo and Dungon: As a rule, these timbers should be saved for the most permanent structures, as posts for mills and other buildings, and special places in tunnels. Tamayuan appears to be more durable than any of the cheaper grade timbers, but if used exclusively for props, etc.; the most accessible supply will soon be exhausted. Little or nothing is known of the comparative durability of the remaining timbers. Two of the most promising of these are Toog and Dao. Magalipac, Marobo and Lauan are much softer and probably much less durable. There is no doubt that all of these timbers are far less durable than the well known first and second group woods. Experience alone will tell which are most suitable. Amuguis, Guijo and Apitong are of a better grade, but are limited in amount.

"On the east side of Barrera Bay there are two areas of mangrove swamps (mangles), occupying in all some 10 square kilometers (2500 acres). These lie at the mouths of the Guinobatan and the Lanang Rivers. The latter is most extensive, and except for narrow strips along both margins of the river, has been little utilized. The Philippine Mining Co. uses exclusively the wood of this swamp as firewood for their dredging engine. The species principally used is Bruguiera parviflora W. and A., known locally as Jangaray. The wood is cut at a contract cost of ₱2.25 per cord, and is transported in a barge a distance of about 5 kilometers for ₱1.25 per cord. This makes a total cost of ₱3.50 per cord. Two cords of this very excellent wood will supply the engine with fuel for one day (20 hours).

"On account of lack of time, no attempt was made to estimate the number of cords per acre. Until such an estimate is made, no accurate information can be given about the number of cords of wood in this mangle. However, it can be stated that at the present rate of cutting the present crop, this excellent wood supply will last a great many years. Reproduction is excellent, and long before the present area can be cut over sufficient time will have elapsed to re-stock the first cut over areas. The danger lies in cutting too closely the forest within easy reach of water transportation. As the edge of the cuttings is pushed back from the banks of the streams and large esteros, the difficulty of transportation will be increased. Although not thoroughly investigated, it is believed that the area within immediate reach of the waterways is so large that a judicious selection of mature timber will bring about a rotation of crops that will keep the cutting area indefinitely within easy reach, so that all firewood can be cut and loaded on boats with little or no land transportation. To be sure, mangrove swamps are so interlaced with tidal channels that the entire body of timber is no great distance from the water's edge, but many of these channels are too small to allow the entrance of barges. The extra handling of the wood along such channels will add materially to the cost. It is therefore to the interest of the company to so conduct their cutting operations as to avoid this extra handling.

"The ore region is some distance from the navigable portions of the rivers that run through the mangrove swamps (see map). Whether or not they use the excellent firewood of mangle or the poor quality of fuel in the timber at hand depends entirely upon the cost of transportation of the former. Mr. Eveland states that the Eastern Mining Company pays ₱4.00 a cord for mangle wood delivered at the mine. The Mt. Cogran Co. is depending entirely on the softer woods found nearest the source of consumption. This is mostly Lauan.

"It is a well known fact that timbers of equal quality will last much longer in temperate than in tropical regions. This is due to the devastating action of the white an and fungus growth. The former is not present in temperate regions; and because of continuous warmth and almost continuous moisture, fungi are more destructive in the tropics. While it is true that there are few timbers like Molave that will last longer in tropical conditions than the best timbers of temperate zones, yet most of the tropical timbers are exceedingly rapid in decay. However, these same timbers, if used in similar situations in temperate zones, would probably last as long, if not longer, than many of the woods used there. This goes to show that the tropical miner cannot expect the common timbers that are placed in his mines to last as long as his experience in temperate regions has seemed to teach him they should. last. Many of the timbers now thought to be of little value would probably outlast the common trees of temperate zones in exactly the same conditions.

"Arrangements have been made with three mining companies in the Aroroy district to label timbers placed in their mines, in the construction of mills, etc., so that they may be examined at some future period as to their durability."

The following notes are extracted from Report on the Forests of Danao, Cebu, and timbers used by the Insular Coal Co., By Forester H. D. Everett. Feb. 1907.

"Much timber was used in the coal mines in former times in the form of ties for the tramway leading from Camansi to Danao. in Cebu, and in the form of posts, caps, and lagging for the tunnels. The company which operated the mines in Spanish times in the majority of cases used the most durable timbers of the first group for the tramway and tunnels, such as Molave and Tindalo. Most of the timber used in the Compostela mines was placed in the years 1895 and 1896. They are mostly Molave, Tindalo, Yacal and Narra, with a few of the inferior or little known species, which grow in the neighborhood. The lagging was poles of Datilis or Caballero. Some of the old tunnels are now being cleared out and new timbers put in where the old ones are no longer serviceable. Thus far, in the Enrique Abella tunnel not more than forty per cent of the old posts and caps have been removed. Many of the Molave timbers are found to be perfectly sound after about twelve years' service.

"An examination was made of several specimen sections which were taken from the ends of the old posts and caps where the timber was in contact with the soil, with the following results:

"Tindalo and Molave posts somewhat affected, but fairly sound.

"Betis posts, good condition.

"Guijo, Bogo and Nipot-nipot posts, badly rotted.

"The timbers from which the above results were obtained were placed in the mines during the period from 1895 to 1897. In general, the caps are sooner affected by decay than the posts.

"In the Camansi mines, a large proportion of the inferior or little known woods of the locality were used, some of which proved very durable, and were almost as durable as Molave for the purpose for which they were intended. Some of these inferior woods are Taguilumboy,



INTERIOR OF THE CLARKE MINE WHERE THE RICHEST DEPOSITS WERE FOUND.

NON METALLIC MINERALS

By WARREN D. SMITH, Government Geologist

I take up the non-metallic minerals first because in other countries where accurate statistics have been kept it is seen that they more than offset in monetary value the metallic products. In the year 1905-6 the total value for non-metallic products in the United States amounted to $921,024,019, while the metallic products came to the sum of $702,453,108.

FUELS

Coal:—Coal has been found in nearly every island of the group; in many places associated with petroleum, and in others not. The coal is pretty much the same throughout the Archipelago, it is a sub-bituminous coal having the appearance and specific gravity of a lignite, but the carbon contents and streak of a bituminous coal. When mined from beds near the surface and beds which have been little disturbed since their deposition, the coal is apt to be very inferior, having only about fifty per cent of the efficiency of Australian coal, but in regions like the Compostela and Danao fields, or the western end of Batan Island, the coal is of a decidedly superior grade. This is due not so much to compression in folding or to volcanic heat as it is to the fracturing of the coal so that a process of dry distillation takes place and a greater quantity of fixed carbon is segregated. The promising coal fields at the present time are as follows: Cebu, in the region behind the towns of Compostela and Danao; the Island of Polillo, which is on the east coast of Luzon about opposite Manila; the southern portion of the Island of Mindoro in the vicinity of Bulalacao, and on a small island just to the south of Bulalacao; Batan Island about twelve miles northeast of Legaspi, in Albay Province; the northern portion of Dinagat Island, just north of Surigao, Mindanao; and near Escalante in the northeast corner of the Island of Negros.

While these coals have stood some very good tests in stationary and marine engines, still they are far from satisfactory, and, following the lead of the United States Geological Survey at St. Louis, Dr. Cox, of the Division of Chemistry, has experimented with these coals with a view to establishing the feasibility of utilizing the gases in gas producer engines. Theoretically his conclusions appear to be correct, i.e. feasibility of utilizing them in this way; but the next step is a mechanical one and it is here that the most trouble has been experienced in utilizing a coal gas in this manner, in the United States and other countries. However, we feel sure that in time the problem will be solved so that it will be a practicable undertaking. I should state here that Mr. Gilkerson, mechanical engineer at the Bureau of Science, and Dr. Cox, are designing and arranging for the erection of apparatus on a large enough scale to make a complete and practical commercial test of this process.

It is not a question with us of quantity of coal so much as it is a question of ability to mine the coal without a loss. In one sense the geology of the Philippines and Japan is very similar, that is in structure, both regions being profoundly folded and faulted, which of course increases the difficulties of mining. In Cebu, during my last visit, I traversed one small creek in which I passed in succession across four coal beds, No. 1 was five feet thick; No. 2 about ten feet thick; No. 3 about thirteen feet thick; and No. 4. two feet thick; and these beds appeared to be fairly continuous, and I may state that a bed of coal six feet thick is considered by many engineers as good as one forty feet thick, in that it is easier to mine.

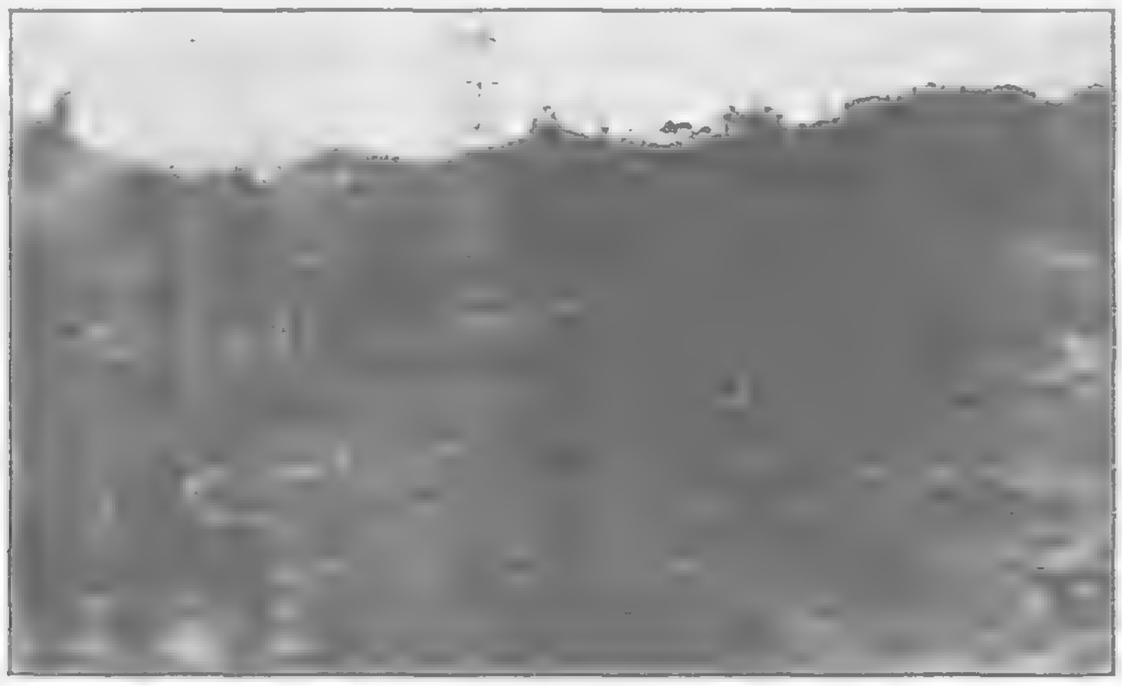
Natural Gas.—In Rizal Province and on the Island of Marinduque some small amounts of natural gas have been found to issue from the ground, but further than this we have no record of these occurrences and so far as I know they have elicited but scant notice.

Petroleum.—The subject of Petroleum I shall treat more at length in another part of this number. Suffice it to say here that small amounts of petroleum have been found in three localities in the Philippines, namely: Tayabas Province on the east coast and Cebu Province on the west coast near Toledo and Alegria. There is, however, a more serious feature connected with petroleum than its geology, which I may say is not altogether favorable in these places. Looking at it from a purely business point of view it is not a good proposition for the simple reason that there is only one concern that can handle oil in these Islands and it is not willing to go out of its way to look into a proposition which does not appear to offer great returns. If someone were to develop these properties and establish several good wells this company might then take hold of it. A small local concern could not survive very long in the field under present conditions.

Materials of Construction.—I am frequently asked if there is any great natural cement rock in these Islands. I have not yet found such nor would it make any serious difference if we do not, for the simple reason that it is possible to take the raw products, limestone and shale, and gypsum and make a far better product than nature. Sometimes nature by accident succeeds in making a very good cement; but this is only an accident and a very uncommon occurrence. We have in several places all the material for our purpose. We have literally hundreds of square miles of a very fair limestone; shale and clay beds are by no means uncommon. With reference to the gypsum I do not know of any considerable amount very close to both limestone and shale deposits, but the amount needed per annum is a mere bagatel and could be easily transported to the factory.

We have more stone than anything else in the Islands and much of it makes a fine road metal, for instance the trap taken from the Talim quarries in Laguna. The Mariveles rock, a hornblende andesite, makes a fine material for breakwaters and railroad embankments. In the vicinity of Manila many cubic feet of a tufaceous stone locally known as 'dobie or Guadalupe stone is quarried and hewn into blocks; these have been used for a great number of years for building purposes in Manila and we find it in nearly every church and wall about Manila. In Ilocos Norte on the Caraon River there is a very good granite which has white mica instead of the more usual darker mineral; this might find some use for ornamental purposes, trimmings and monumental stone.

Abrasives.—In the southern islands there is considerable development of sandstone which would work up well into grindstone, and on the Muao river, Cebú, I found recently a deposit which appears to be very similar to the novaculite of Arkansas in the United States, which is the material from which our finest whetstones are made.



Permission Division of Mines.
THE ONLY OIL DERRICK IN THE PHILIPPINES. ERECTED IN CEBU.

Hambabae, Putian, Camungayon, Mata-mata, and Amahuyam, all of which have proven fairly satisfactory.

"The conditions affecting the durability of mine timbers are different from those affecting an harigue or other timber exposed to light and air. The mining timbers are in almost complete darkness, are constantly dripping with moisture, and are covered with a slime. The air inside the tunnels is heavy, hot, laden with moisture, and varies little in temperature. Except at the entrance to the tunnels, the Anay is said not to work, and no injurious work of insects was observed in the old timbers; consequently conditions are not such as to cause the most rapid decay, though favorable to the growth of destructive fungi.

"The timbers used in the mines at present are in the form of posts, caps, and lagging. For each 100 meters of tunnel are used 340 posts, 170 caps and about 7000 short stakes for lagging, having an approximate volume for posts and caps of about 120 cubic meters. The wood used for lagging is a small stem of the Datilas or Caballero, a brushwood growing in thickets near streams.

"A coal mining operation on a fairly large scale would run about 1500 meters of tunnel per year, which would require about 300 cubic meters of timber for posts and caps, exclusive of the timber for the tramway and for general construction. Since the company is now working on a small scale, clearing out old tunnels and starting a few new ones, only a small amount of timber is required. This demand can be supplied by the neighboring forests for awhile, but as soon as the operations are increased, and J. G. White & Co. also commence extensive operations, it will be necessary to secure timbers from other sources.

"The Dungula growing on the tract of the Insular Lumber Co. should be an excellent mine timber. The Lumber Company are now cutting it, and from time to time a steamer load might be secured.

"Only further experience and observation will prove the suitability and durability of the many little known timbers of the islands for mining purposes. Some of these will undoubtedly prove very satisfactory.

"It is probable that in time it will be practicable and advisable to treat mine timbers with preservatives, thus enabling the use of the more abundant and cheaper kinds. Painting timbers with preservatives, or giving the timber an open bath treatment, will be found the cheapest method."

CHEMICAL MATERIALS

Gypsum.—Gypsum has been reported from several localities, but we have as yet no figures as to the extent of the deposits. One locality in the Loboo mountains, east of Batangas, appears to be quite promising. Gypsum would find use not only in cement manufacture, but also in the making of Plaster of Paris.

Phosphate.—Phosphate occurs in several different forms, in the mineral apatite as phosphorite or rock phosphate, land pebbles, and in guano, which is formed from the excreta of sea birds and bats. In nearly every cave that one enters over here he finds a dirty, coarse, granular soil on the floor, varying from a few inches to several feet in depth; this is usually guano, a bat guano, and if found in considerable quantities, say from several hundred to a thousand tons, it could be mined with a profit. The Island of Marinduque is said to have many caves containing this deposit. In one case as much as five hundred tons were estimated to be in a single cave. The only people in the east who handle this, I believe, are the Japanese.



TAYABAS OIL FIELDS—VIEW OF BAYHAY RIVER AT POINT OF OIL OUTCROPPINGS.

Pyrite.—The chief use for pyrite is in the manufacture of sulphuric acid. As yet I have neither seen nor heard of any extensive deposits of this mineral, though it is probably the most widely disseminated of all the metallic minerals. I do not believe a plant erected for the purpose of making sulphuric acid alone would pay over here, but as a by-product incident upon the treatment of pyritiferous ores it should find a ready market.

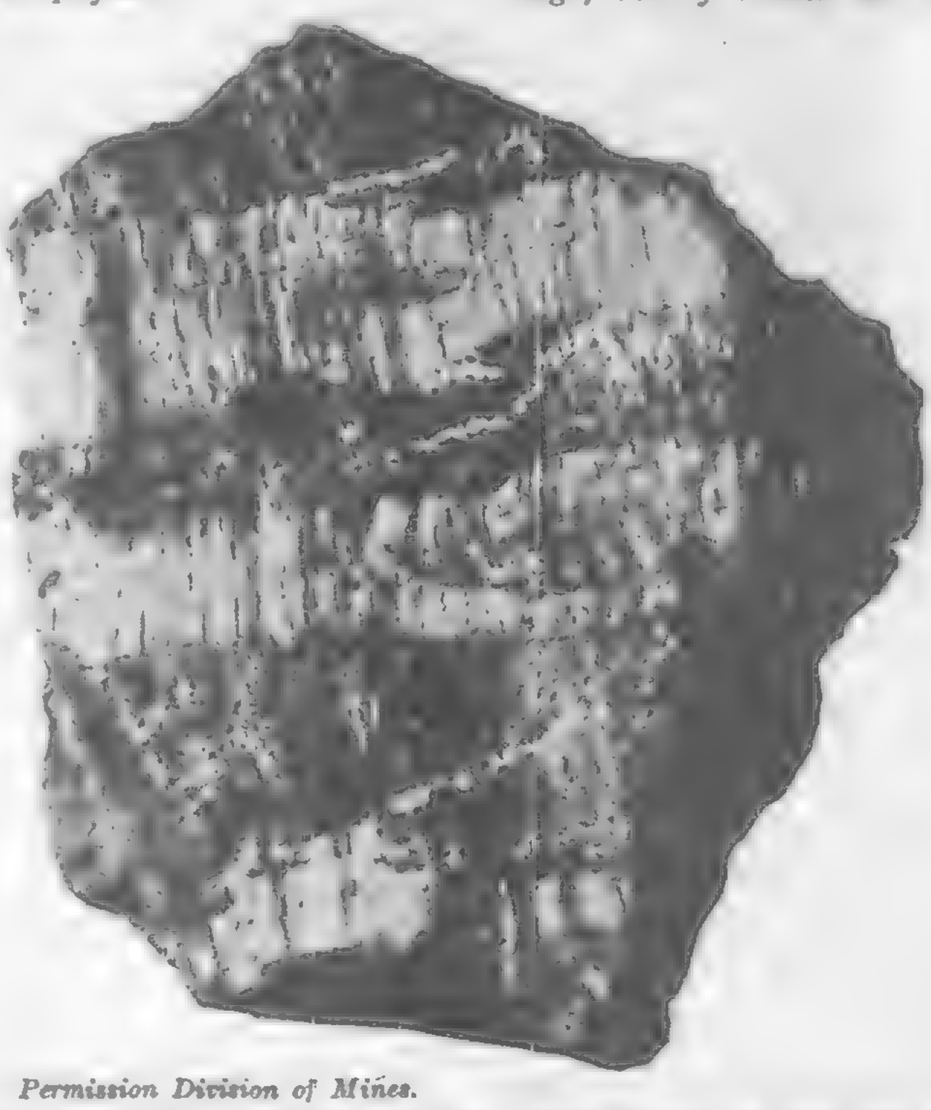
Sulphur.—Sulphur in small quantities has been found in Leyte, in Mindanao, in Luzon, practically everywhere where there has been any recent vulcanism. On a recent trip through Leyte Mr. Goodman, of this Bureau, made a very diligent search for sulphur, visiting some of the locally well-known solfataras, but besides a few tons he did not find any commercially valuable deposits. Were we to find any considerable product of sulphur here it would be a distinct advantage, in that sulphur is needed in the making of certain kinds of paper. Very good paper has been made by Mr. Richmond, of this Bureau, from abacá and cogon waste, but sulphur is needed in the process. Perhaps some mountain like Apo, which is known to be in a declining, or quiescent stage, will be found to have some sulphur near its crater. I have no doubt in my own mind but that there are considerable buried deposits of sulphur intercalated in the general lava flows which will be uncovered at a later time.

Salt.—As yet we have come across no natural salt deposits in the Philippines.

Mineral Paints.—In Ilocos Norte, as well as many places throughout the Islands, there are considerable accumulations of yellow and red ochre which ought to make a very fair article. A great deal of the ground mica and actinolite, greenish in color, might also be worked up into a fair grade of paint.

MISCELLANEOUS

As I am treating in another part of this paper the topics asbestos and manganese more at length, I shall pass briefly over them, making the statement here that indications of asbestos have been found in Ilocos Norte, but that no first grade variety has been located as yet; that there are not a thousand or millions of tons of the article in sight, as some reports have had it, and that there is no need of anyone rushing headlong into asbestos mining. Some of the asbestos is fibrous serpentine, but most of it is an amphibole under the name anthophyllite.



Permission Division of Mines.

ILOCOS NORTE CHRYSOTILE VEINS ABOUT ONE HALF INCH THICK.

Felspar.—Felspar is valuable for glazing purposes in the manufacture of porcelain. Near Caraon River in Ilocos Norte there is a considerable deposit of disintegrated quartz and felspar which might be so separated that the felspar could be used in the porcelain industry and the quartz used in the manufacture of glass. This would not make the best quartz for glass manufacture, such as that derived from a pure sand or a crushed quartzite, but still I think it would do very well.

Magnesite.—Magnesite or magnesium carbonate is usually found along rifts in serpentines and pyroxenites. I have seen some patches of it on Batan Island off the Albay coast and in Ilocos Norte, but none in commercially valuable quantities.

Manganese Ore.—Manganese ore in the shape of pyrolusite, psilomelane and wad have been found in several parts of the Islands; in Masbate, in the Aroroy district, there is so much of it that it is mixed through the vein matter and causes a great deal of trouble on the mill plates. On the road from Capiz to Iba, in Zambales Province, a deposit of manganese ore has been penetrated by the road, but we have no figures as to the quantity. In Ilocos Norte there is a very peculiar occurrence of it, for there it is found as nodules, varying from a half inch to two and three inches along their longest diameters, usually somewhat flattened rather than round. These nodules are found scattered all over the surface over acres of ground and in some places in natural troughs between hills they are concentrated to the thickness of a foot or more. It is essentially a blanket deposit of natural concentrates. As yet I have seen nothing to lead me to believe the deposit of sufficient extent and depth to be of commercial value, though not enough development has been done to enable one to make a fair estimate.

Mica.—No sheet mica has up to date been found in the Philippines, but in Ilocos Norte considerable pockets of a very triturated mica occur. This could be used for lubricants, "frosting" for Christmas effects, etc., and were some small leaves of mica to be found they could be united into larger sheets and used for insulating certain parts of electrical apparatus.

Mineral Waters.—Since the year 1893, the date of the publication of the work entitled "Estudio Descriptivo de Algunos Manantiales Minerales de las Filipinas," by Abella y Casariego, Vera y Gomez and Rosario y Sales, no work of any importance has been done on spring and mineral waters. Many individual waters have been analyzed, but these have not yet been collected into one publication. Some of the well-known springs recorded in this work are as follows:

1. The spring of Lanot, near the pueblo of Diet, in the Province of Ambos Camarines. This water contains iron and carbonic acid.

METALLIC MINERAL RESOURCES

* By MAURICE GOODMAN.

GOLD

Of the metallic mineral resources of the Philippines, the noble yellow metal is easily the first and foremost in importance. It has been sought for and found in most of the provinces of the archipelago, but of them all the provinces of Benguet and Masbate rival for first place in the metal output and in general mining activity. Numerous claims have been located in both these provinces and several corporations have lately been organized to develop and operate several of the most important groups of claims. The success of some of the companies that have entered the field still remains in doubt, while that of others, to judge from their continuous operation and constant output, might naturally be considered assured although their financial reports are not available. There are other companies that have not yet attempted to break into the producer class but have exerted their energies in developing their properties and in blocking out ore. From these good reports are anticipated in the near future. As the mineral resources of the Philippines have been discussed at length in all the annual reports of the Chief of the Mining Bureau, copies of which may be obtained upon application, it will be necessary here only to make mention of the recent discoveries and developments.

Two new stamp mills have recently been imported into the islands. One, a Hendy Quadruple discharge six-stamp mill, will be erected in Benguet, and the other, a ten-stamp mill of the Risdon type, is now being erected in Masbate. On the other hand a ten and a five-stamp mill have been shut down in Masbate, so that the prospects for an increased output this year seems doubtful. New discoveries have been made, however, which promise well for the future. At Binanlonan, in the northern part of Pangasinan, some rich but narrow veins of free milling ore have been discovered and at least two companies are engaged in active exploration work in that field. Unfortunately internal dissensions have been interfering with a rapid progress in this district, but with the settlement of disputes the outlook for the new mining camp seems favorable.

The island of Marinduque also offers a new, but small, field for the prospector. Recent discoveries conclusively prove the presence of gold-bearing veins, and while no bonanzas have been encountered the company most active in prospecting the district declares itself well satisfied with the showing thus far made and is prepared, should the prospects continue favorable, to open up and develop its properties on a larger scale.



MANCAYAN COPPER MINES.

2. The spring of Pansol, near the pueblo of Calamba, Province of Laguna. This contains bicarbonate of soda and potash.

3. The spring of San Mariano de Nagtanglan, pueblo de Pozorrubio, Province of Pangasinan.

4. The Spring of Mainit de Bosoboso, pueblo of Bosoboso, Province of Rizal. This contains sulphur and hydrogen, besides nitrogenous matter.

5. The spring of Mulag, pueblo de Carcar, Carcar, Province of Cebu, whose water is much the same as that from Bosoboso.

6. The spring of Tagdag or Bolocboloc, pueblo of Barili, Province of Cebu. This contains a mixture of bicarbonates.

7. The spring of Neabe Rancheria, Itogan, in the Province of Benguet.

8. The spring of Cotabato, pueblo of Cotabato, Mindanao, and several others.

However, the two most important today and which are not here mentioned are the water of Sibul Springs, near the pueblo of San Miguel de Mayumo, in Bulacan Province, and the Los Baños water, better known as Isuan. Both these waters have a reputation for beneficial medicinal qualities. The Sibul Springs water has a temperature of only about 82° Fahrenheit and contains sulphide of hydrogen. It is a very soft water and pleasant to drink. Its lack of heat, however, makes me think that the beneficial effects due to bathing in it have been somewhat exaggerated. The good qualities of Isuan have been added to by artificial charging with gas; however, its high temperature combined with its mineral ingredients, is said to make it a splendid curative for certain ailments.

Precious Stones.—No stones of gem quality have been reported; however, in Ilocos Norte I have seen some poor specimens of opal which showed a little fire. Diligent search in this region might bring some very fair specimens to light. Some small topazes have been found in streams in Ambos Camarines.

Pumice Stone.—In a region of such great vulcanism as ours we ought to find quantities of pumice; in fact, we do find a great deal of pumice fragments scattered throughout the tuff deposits around Manila, but I have seen no big pieces of it so far.

Quartz.—Near the pueblo of Pasuquin, in Ilocos Norte, there is a dike consisting largely of quartz and felspar. This rock could be crushed and the two minerals separated, the quartz could then be used in the manufacture of glass. Ground quartz is also used as a filler in paints, as an abrasive, and the larger quartz crystals might be sometimes used for spectacle glasses.

Sand: Molding, Building, Etc., and Gravel.—We have no statistics at hand in regard to molding and building sand and gravel. For building sand we have an abundant supply on our beaches; and in the beds of our many rivers we have an unlimited amount of gravel, great quantities of which are being used every year on roads and in concrete work. The only sand that we have found at all approaching a molding sand, which of course must have certain properties, is a sand occurring as intercalated beds in the tuff deposits near the city of Batangas. This sand is very fine-grained, free from pebbles, and can be molded into any shape desired: I think the supply is unlimited.

Talc and Soapstone.—The only talc that I have so far seen in the Philippines comes from Ilocos Norte, near the pueblo of Pasuquin. It occurs in irregular pockets with micas and the schist area bordering the serpentine mass. This talc would doubtless find ready application as a loading material for paper.

I have not seen any soapstone nor have I any reports of its occurrence.

* Mining Engineer, Division of Mines.

The gold mining industry in the Northern Camarines has been showing signs of awakened interest. While this is more true of placer than of quartz properties, the latter too, have been the subject of negotiations recently, which, if successfully concluded, may bring about a resumption of mining operations here. These properties are reported to have yielded much rich ore in the past and were the only mines operated with an approach to modern methods during the Spanish regime. For various given reasons these mines have been abandoned and are today in such a condition that it would require a considerable expenditure of money to put them in working shape

The most interesting and, probably most important of the recent discoveries of gold, was made in the Suyoc region of Southern Lepanto where the Igorots have been working and washing gold ores by the most primitive methods for a hundred years or more. Many years ago they were drowned out of their richest diggings, which, on account of the topography of the country, they could not work by their usual booming method. By means of a drainage tunnel an American prospector recently removed the water from one of these flooded workings and sure enough found the rich ore which tradition reported to be there. In association with the free gold there was observed a silvery white mineral which has since been identified as the mineral calaverite the first authentic report of the occurrence of telluride of gold in the Philippines. No report as to the extent of the deposit or the average assay value of the ore has yet been made.

From the placer deposits of the Philippines no great amount of bullion was produced last year. One dredge has but recently arrived at its real working field, having been engaged heretofore in laboriously dredging its way through comparatively poor and more or less barren ground. A New Zealand syndicate imported a gold dredge last year which has since been put together and floated in the Paracale river. Another dredge, which is now lying idle in Masbate, may be transferred to the Camarines in the near future to assist in the exploitation of this rich field.

In Nueva Ecija, ditches and flumes have been constructed and everything is prepared for a profitable sluicing campaign during the coming rainy season, whereas in the placer fields of Northern Surigao, while considerable prospecting has been done during the past year, no extensive mining operations have yet begun.

COPPER

With the exception of the small amount of copper which was formerly smelted by the Igorots for use in their clandestine manufacture of "sipings", scarcely a dollar's worth of copper has been produced in these islands since American occupation. Nevertheless this metal is readily conceded to rank next to gold in importance as a natural asset of the Philippines. It holds this position both on account of its past record as well as its widespread occurrence throughout the islands, being a frequent associate of gold in the ores. The non-production of copper of late years must necessarily be attributed to the absence of smelters in the islands, and to the difficulties of transportation from the mountain regions where the ore has been found, to the nearest port from which the product could be shipped to foreign smelters. With the investment of a moderate amount of capital these difficulties could be overcome, either by the erection of a furnace near the mines or the improvement of transportation facilities. The Mancayan copper mines, which are the most important and best known copper deposits in the Philippines, have lately come under the control of a local syndicate composed of American and English capitalists. This company has applied for a franchise to build a railroad from Mancayan to Bangar, a town on the western coast of Luzon. If this franchise is granted and the road built, a most important step towards the upbuilding of the mineral industry of the Philippines will have been taken, for not only is such a road of prime importance to the interests of the copper company but all of the gold mines of Suyoc and Northern Benguet may be benefited by it.



OLD PUDDLING MILL USED TO HANDLE DIRT FROM DREDGE ON OLD PARACALE WORKINGS.



MAKING BORING TESTS ON PLACER GROUND IN MALAGUIT RIVER.

From Eastern Pangasinan have recently come very promising looking specimens of the carbonate ores, but as to the extent of the deposits no authentic reports have yet been received. Similar specimens, but no more data, have been received from Cagayan de Mindanao. Large boulders of chalcocite float carrying very appreciable quantities of gold and silver have been encountered in Marinduque, but thus far the mother lode has not been discovered. Native copper occurring as a very thin stringer in igneous rock has been discovered in Masbate, and in the same region rich carbonate ores carrying gold and silver have been found.

SILVER

Native silver has been obtained only from one of the Suyoc mines, a short distance from where the telluride of gold was discovered. Some rich assays of this ore have been made As an associate of gold it is found in many ores, but in most of them only in inappreciable quantities. With lead it has been determined in the argentiferous galena of Marinduque and Cebu, running over 11 ozs. per ton in the former, while in the latter the proportion is unknown, although it is reported to be high.

LEAD

No development work was performed on any of the lead deposits of the Philippines during the last year. The outcrops in Marinduque and Cebu were visited by representatives of the Mining Division of the Bureau of Science but the lack of development work made it impossible to formulate a conclusive report upon the probable importance of these deposits. A few of the gold ores of the islands contain a sufficiently high percentage of galena to make it a factor in the estimation of the smelting cost. Large pieces of galena float were found in conjunction with the chalcocite float mentioned above, but as already stated, the parent lode of these boulders has not yet been discovered. In Cebu the galena occurs as a "stockwork" in an andesite flow.

IRON

No new developments have taken place in the iron industry of the Philippines during the last year. In the Angat region an improvement in the conditions was caused by the termination of the legal disputes, which had been causing more or less molestation to the operators for the last four or five years. An increased economy and possibly output may follow as a result of this settlement, but no new discoveries or modifications of the methods employed are reported. The new wagon road being built between San Miguel de Mayumo and Sibul may prove an impetus to the iron smelters of that district, as it will permit a greater economy in the cost of transportation of their product from the mines to the railroad, which has always been one of their largest expenses. Iron ore has been discovered in Marinduque but under conditions which makes it unlikely that an iron industry will spring up there within the near future.

TIN

Considerable stir was caused some months ago by the reported discovery of tin ore in Mindanao. As such a discovery had long been hoped for, the report gained considerable credence at first. A brief investigation however, proved the reports to be false. It was discovered that the specimens used to beguile the public had been imported from Australia. No authenticated discovery of tin has up to this time been made in the Philippine Islands.

VALVES AND SLUICE GATES FOR MANILA WATER SUPPLY

Attentiou is directed to the advertisement of the Municipal Board of the City of Manila, inviting bids for the supplying of valves and sluice gates for the new gravity water supply, which appears in another column in this issue of THE FAR EASTERN REVIEW.

COAL IN CEBU

By W. D. SMITH (*)

Never before, in all probability, has the outlook for a healthy colliery industry appeared brighter in these Islands. Two of the old camps left in such a sad way largely through the vandalism of insurrectos, are being rehabilitated while explorations are in progress in a third and entirely new field. And in the meantime a thousand or more laborers are rushing to completion across hill and paddy and river the railroad which will bring this coal to the shipsides.

Metal mines of course help develop the country; but we believe we do not exaggerate when we say that when these Islands produce their own coal a new and distinct era will be inaugurated.

At present there are three parties in the field investigating every possible feature of the coal A New York syndicate has two experts, one a mining man and geologist who in former years has been identified with the coal mining industry of Japan, the other a young engineer who has had experience in West Virginia and Kentucky coal fields. These two men and their party are investigating a region in the vicinity of Mt. Mangilao, about six miles due west of the pueblo of Carmen. The second party is now working on both the old properties: Camansi, five miles west of Danao, on the river of the same name, and Licos, about two miles south of the Camansi fields. This party represents a syndicate of prominent New York and Manila men. The third party is the government party, consisting of one geologist and one mining engineer and their assistants. Their survey of approximately forty square miles of territory has just been completed. This survey is based upon a topographic map (transit and stadia) made about a year ago by two topographers from the Division of Mines, Bureau of Science, on a scale of 2,000 feet to the inch and with a contour interval of 50 feet. This map has been of immeasurable value not only to the government surveying party, to whom it is practically indispensable, but also to the private corporations who are preparing to develop the mines, as well as to other private individuals who have located claims but are not yet prepared to develop them.

The work being carried on by the two private parties consists largely of development work, opening up the coal beds, shafting and drifting to determine extent, continuity, etc., and thorough sampling.

In the two older properties already referred to much work is being done opening up old galleries and running new drifts.

From all these fields large samples of three to four tons each will be taken for a special grate test to be carried out at the Bureau of Science.

The work being carried on by the government party consists largely in geological investigation, i. e., in mapping all the formations, coal measures, limestone capping, igneous rocks, basal flaws and intrusives, their surface extent, boundaries, and from dips and strikes on the surface and from underground workings their positions and boundaries underneath, probable course of coal seams, etc.

In the prosecution of this work every stream and nearly every arroyo has been traversed, and every hill top ascended. In this work, the traversing of streams and arroyos has been the most productive of results, as it is in those places that one finds the best outcrops and sections of the beds. The two greatest obstacles to the work in this field are the excessive growth of "cogon and ticbao" and the great accumulation of weathered material and talus which nearly everywhere completely conceals the formations below.

At this time it might be well to state some of the general features brought out by such a survey of this field.

The district is one in which the geology is quite disturbed, but not in excess, it is believed, of other coal bearing areas of the Archipelago. It certainly has some features possessing advantages over the others of the island of Cebu, where coal can be found from one end to the other.

The three fields being developed at present are rather limited, but amply sufficient for considerable coal production.

The coal seams are rather highly inclined, from 30° to 90°, which will necessitate some system as the "Battery" or some similar method being employed in mining.

Both the roof and floor are weak, so that great care will have to be taken in the timbering. There will also be some considerable expense in obtaining suitable timber and preserving it when placed in the workings. Forepoling will be necessary.

There is evidence of considerable minor faulting, but probably none that will seriously affect mining operations.

There are probably five seams that can be counted on, at least two of which are over ten feet thick.

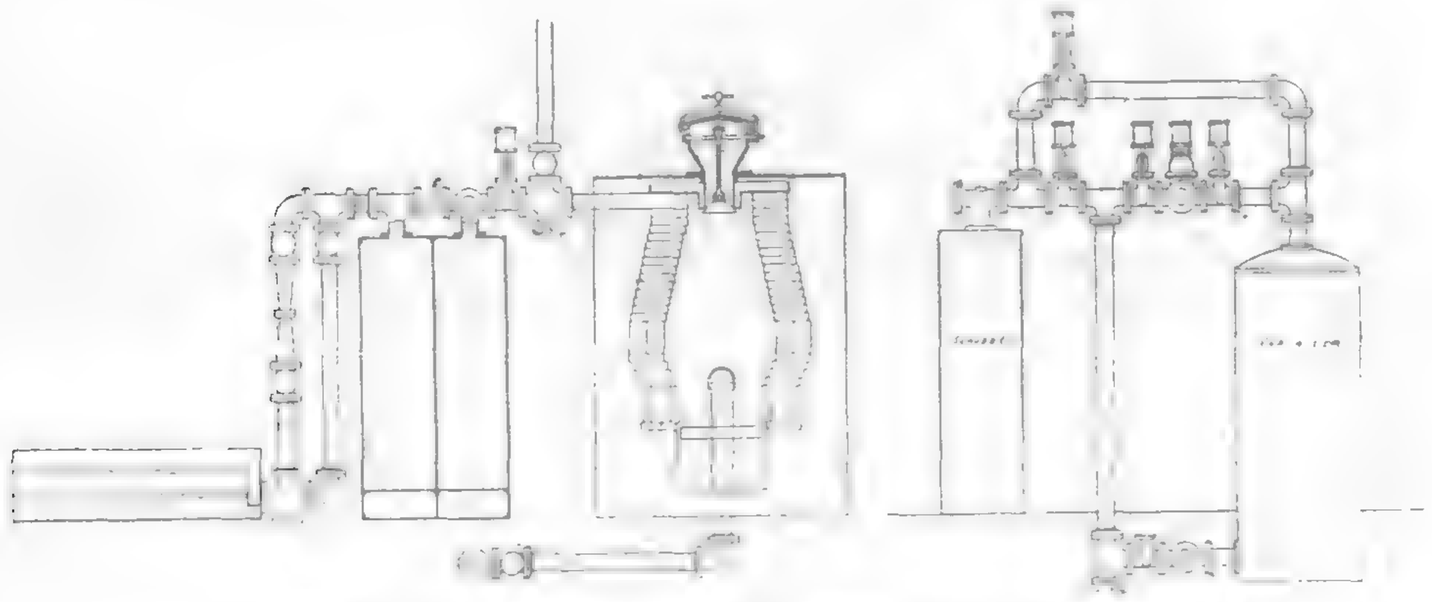
Transportation is one of the most serious items and it seems likely that some such schemes as inclined planes or overhead cableways will have to be resorted to in parts of the district.

At the old Licos workings, where formerly there existed over 300 meters of drifts, about 100 tons of coal, taken from the "Esperanza," "Ramoncita," and "Enrique Abella" galleries have been on the dump for three or four years. In this time the coal has not taken fire nor has it "air slacked" very greatly, which bodes good for its handling and storage.

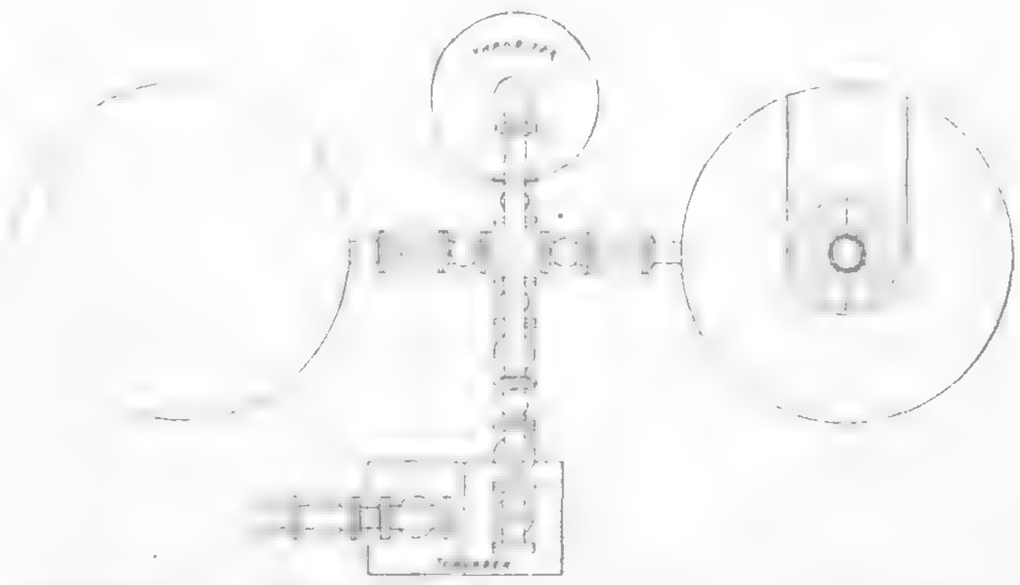
The coal throughout the district is remarkably free from dirt, clay partings and "bone" and is quite low in sulphur.

We believe that this coal will ultimately find its greatest utility as a gas producer and with that in view it should be mentioned that Messrs. Gilkerson and Cox of the Bureau of Science are devoting much of their time experimenting on this problem and hope at no distant date to make a practical demonstration in this direction.

In the course of the geological survey of the region a number of igneous formations, both deep seated and extrusive, have been found, but their exact relations to the coal will have to be worked out more slowly and will appear on the final map. It is not believed that they will seriously affect mining operations save in a few places.



SECTION OF PLAN OF BUREAU OF SCIENCE GAS PRODUCER.

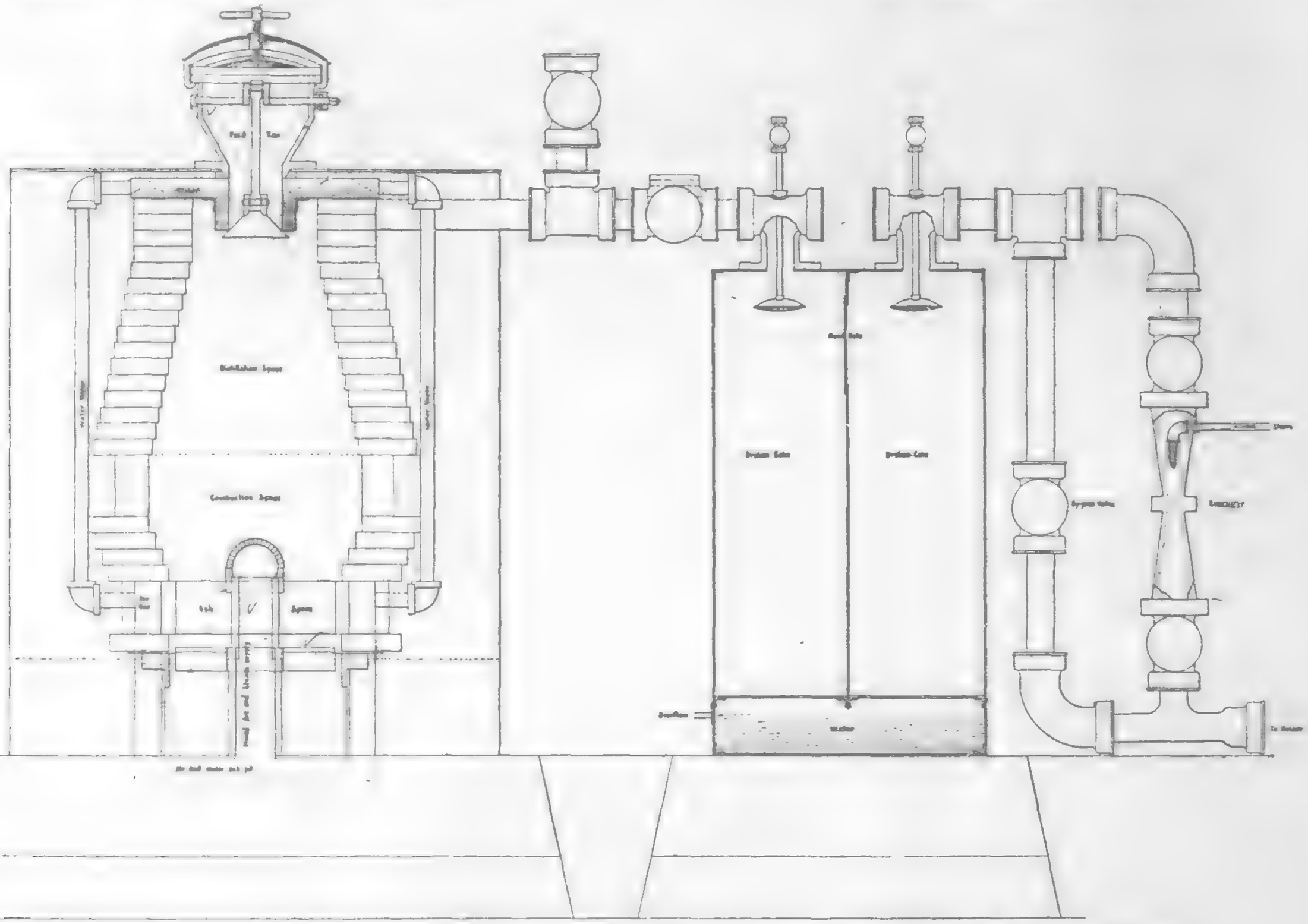


SECTION OF GAS PRODUCING PLANT AT BUREAU OF SCIENCE.

(*) Acting Chief Division of Mines.

PRODUCER GAS PLANT FOR THE BUREAU OF SCIENCE

The Bureau of Science is preparing at some expense to make a complete, practical test of Philippine coal for the utilizing of the gases for commercial purposes. For this purpose Mr. Gilkerson, mechanical engineer at the Bureau, and Dr. Cox of the division of chemistry have prepared designs for an apparatus to be installed at an early date and the result of their experiments will be awaited with great interest. In connection with this project the following descriptive article accompanied by drawings has been furnished the FAR EASTERN REVIEW through the courtesy of the Bureau of Science:



PRODUCER GAS PLANT FOR THE BUREAU OF SCIENCE, MANILA, P. I., DESIGNED BY J. A. GILKERSON, M. E., CHIEF ENGINEER.

"The construction of two gas-producers will enable the Bureau to produce water-gas for Laboratory purposes as well as producer-gas for fuel, to be used under the boilers.

"In the design shown, which is somewhat on the lines of the Loomis-Pettibone system and is designed to be constructed of reinforced concrete about a lining of fire-brick which may be easily gotten at for renewal and repairs.

"The plant consists of two generators, a scrubber and a small steam boiler, with necessary piping and valves to connect with the present gas holders, all valves to be operated by hydraulic switch board on the charging floor of the building containing the apparatus.

"The building to contain this apparatus need be of the simplest construction as protection from the weather and preferably fireproof. Ground floor of earth or cement, charging floor of iron plates, and roof of corrugated iron.

"The gas plant to be near to but separate from the coal house at present used in connection with power plant and will cover approximately 16′×28′ ground space.

"In the construction of the producer units the use of reinforced concrete is recommended in preference to iron plate, as a fewer number of fire brick would be required, also giving better insulation, which is important in gas producers.

"The Bureau of Science has on hand an iron tank of suitable size which can be cheaply converted into a gas-scrubber, and also a small upright boiler now used as an auxiliary for pumping purposes; this is the boiler shown in the drawings, but if not desirable to use this one, another of near the same size may be substituted.

"Another and important improvement over the Loomis-Pettibone apparatus is that by the system of by-pass valves, the gas generated in either unit may be passed through the other from either above or below. This is an advantage as recourse is in this manner had to the hottest part of the second fuel bed which cracks a greater amount of the solid carbon which would otherwise condense as soot and tar.

"In the design of this gas-producing plant there are few parts which may not be purchased in the open market or through Manila merchants, and these special parts can be made in local foundries.

"As regards patent infringement, Engineering News, Vol. XXIV, p. 317, 1890, has a "Discussion of Fuel Gas," giving illustrations of the Loomis system.

"It will be possible to make a large saving by using the low grade Philippine coals in a gas-producer which cannot be used to advantage by being burned directly for steam purposes. Also, the producers at present in use at the Bureau of Science, with the extra parts now on hand, will not, without extraordinary outlay, last another year, and even in case they were renewed from time to time the consumption of coal required to make gas from oils would furnish practically the same amount of gas if converted direct with proper apparatus."

The following is from "PRODUCER GAS AND GAS PRODUCERS," by Wyer, N. Y., 1906:

"There are only two classes of plants where the use of producer gas for firing steam boilers may be justified, in the light of present-day gas engine economy:

"First in plants that require steam or hot water in the process of manufacture, as the soap and paper industries.

"Second, in existing steam plants where the change to gas power cannot be made, and yet where it is desirable to eliminate the smoke nuisance.

"Producer gas will give better results than direct firing in either of the cases named, but in new plants for power generation it should be used directly in the gas engine, and thus eliminate the boiler entirely.

"In general, no economy of fuel will result by first gasifying solid fuel in a gas producer and then burning the resulting gas under a steam boiler. The advantages to be derived from such an arrangement usually lie in other directions, and are given in detail.

ADVANTAGES:

"1. With gas, complete combustion may be secured with practically no more than the theoretical amount of air.

"2. It is much easier to maintain a maximum economy than with solid fuel.

"3. Personal feelings or indifference of the firemen do not affect the operation of the boiler, and steaming is much more regular.

HISTORY OF PLACER MINING IN THE CAMARINES

Whatever may be the respective merits of the different districts of the Philippine Islands as to the quality and quantity of valuable mineral deposits, the supremacy of Camarines Norte as a rich field for historical research in mining lore can hardly be disputed.

There are abundant proofs at hand that both its lodes and its placer deposits have yielded profitable returns for several centuries. Ever since the Argonauts set out upon the search for the Golden Fleece there has been a glamour about gold-hunting that lends itself readily to exaggerated speech in dwelling upon the glories of this, that, or the other Eldorado. Due allowance must be made at all times in dealing with the tales of prospectors who see through rose-coloured spectacles. Be this as it may there is abundant material for speculation and comment to be found in the mining districts of Paracale and Mambulao, lying on the North-east coast of the sub-province of Camarines Norte. Here, centuries ago, the natives were "gophering" out with their simple tools the hearts of the free gold veins and washing out the alluvial deposits from the streams with their wooden dishes (*pabirics*) with a skill not excelled anywhere in the world.

Mr. Richard von Drasche, a German geologist who has done some field work in the Islands, and who has published important papers upon Philippine geology, states that at the time of his visit to Mambulao and Paracale there were over 700 natives working the placer deposits for gold. It was estimated by a Spanish governor of Manila of the seventeenth century that the annual output of gold from Camarines Norte was about $200,000. This seems well within possibility and is an indication of what was yielded to native methods. The natives in no part of the Islands have been able to dredge or sluice, nor have they penetrated more than 50 or 100 feet into the rock at any place.

Before the advent of the Spaniards in these Islands, the gold won found its way into China through the medium of Chinese traders who visited these shores in their junks. This mining section was also a favorite raiding ground for hordes of Moro pirates, attracted thither by the gold. The early Spaniards, finding the richest of the alluvial deposits worked out, "impressed" the native miners and started work on numerous veins. Here again, in most instances, the natives had been ahead of them. With small shafts and drifts they had extracted the payable oxidized ore. Water and the changeable character of the ore, together with the want of pumps, formed always an unsurmountable barrier to further progress. Nevertheless some of these reefs were worked by the Spaniards in a primitive fashion—using "arrastres" for crushing. This device was introduced from Mexico, and consisted of two or more



GETTING READY FOR THE DIGGING LADDER. | BROADSIDE VIEW OF THE PARACALE "DIGGER". | MOUNTING THE BIG REVOLVING SCREEN.

"4. Gas-firing of boilers presents an adequate economical and practical solution for the smoke nuisance. The entire prevention of smoke is decidedly better than attempts to 'consume' it. To prevent the formation of smoke it is imperative that the combustion be practically complete before the gases impinge on the cold surfaces of the boiler; thus the deposition or condensation of unburned particles of carbon is prevented.

"5. With gaseous fuel, the life of the boiler is much longer, due to the elimination of the excessive strains produced by alternate heating and cooling caused by hand firing.

"6. Less labor is required, including the operation of the producers, since they may be charged with fuel much more easily than a steam boiler.

"Results given by Blauvelt (Cassier's for December 1894, p. 123) on the application of producer-gas to return tubular boilers 'resulted in the prevention of all smoke and an increase in the evaporation capacity of the boilers by over 12%, as compared with the results of the same coal burned on the grate at the same time there was a saving of about 15% in the amount of fuel used."

It is believed that the coal mining industry of the Philippine Islands as yet undeveloped may find an impetus if the product is found to be more economical by utilizing the coal gases in producer-gas engines. So far only a chemical test of the coal has been made in order to establish the value of the Philippine coal as thus utilized and theoretically there is every reason to believe that it can be used successfully and economically compared with the prices paid for imported coal at the present time. However no commercial test has yet been made and until the Bureau of Science completes its work in this direction judgment is suspended. Dr. Alvin J. Cox of the chemical laboratory Bureau of Science, in an interesting paper on "Philippine Coals and their Gas-producing Power," gives the following table and comment on the result of his experiments:

Name of gas.	Actual yield of gas per kilo of coal.		Actual yield of gas per kilo of combustible.		Actual yield of gas per kilo of volatile combustible.		Calories per liter.
	In liters.	In cubic feet.	In liters.	In cubic feet.	In liters.	In cubic feet.	
Batan coal.	365 955	12.922	452.255	15 97	854 380	30.89	3 125
Cebu coal..	305.020	10.770	359.100	12.67	697.986	24.65	4,295
Polillo coal	320.648	11.322	364.245	12.88	782.260	27.60	5,254
Negros coal	267.570	9.448	359.350	12.69	826.088	29.14	4,527
Australian Zeo.....	302.305	10.674	344.925	12.15	758 227	26.77	5,135
amaboanga coal.....	227 845	8.045	264.820	9.39	645.270	22.22	5,616

The regions represented by this investigation include the largest coal fields of the Islands and show wide distribution. Since the character of the coal in the Philippines and the facts of the gas tests are so nearly the same, conclusions may also be drawn from these results regarding the other regions. Furthermore, it is probable that equally good or even better results could be obtained from a study of the other coals.

An investigation of the by-products of the distillation of these coals has not been made, but it can be stated that the yield of tar is comparatively small.

The producer-gas plant depends not only on the production and utilization of the ordinary coal gas but also on the partial combustion of the fixed carbon which, in an ordinary gas plant, is left behind. Carbon monoxide, the product of the partial combustion, is of comparatively low calorific value, much lower than that of the gas produced from the volatile combustible matter. This explains the results of the work of the United States Geological Survey which show, when viewed from the usual steaming standpoint, that the quality of the producer gas "improves as one descends in the scale of quality of a coal, the best results being obtained from brown lignite." The same tendency is noted in the gas-producing power of native coals, as shown below:

This fact is of importance to the Philippines as it suggests a method for the utilization of the low-grade fuels. The disposition of the outcrop coal, which must be mined in opening up the works, and the use of the slack is the question now to be considered and the problem which we must solve. My investigations have been made with outcrop coals of a low fuel ratio, with the particular object of determining their utility. The above results show that the coals tested have satisfactory gas-producing power and could probably be used in a producer plant with excellent results.

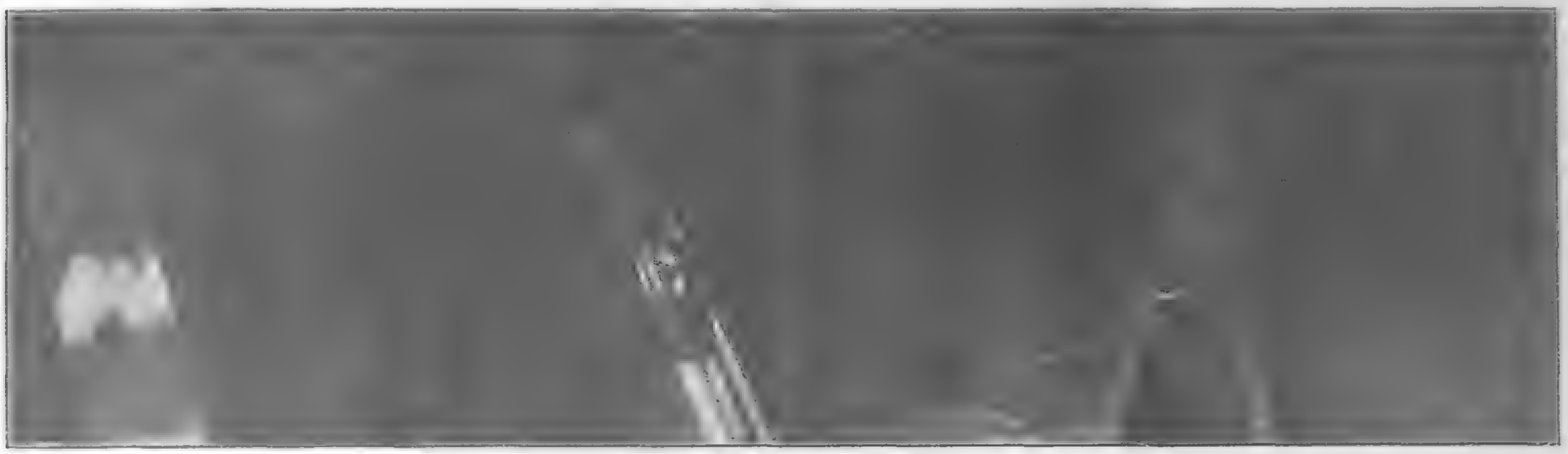
Physically, the Phlippine coals are ideal to handle in a producer furnace. They do not swell, they burn steadily, form no clinkers, and the ash would easily be removed automatically. Since the quantity of ash in a producer plant is of no material consequence, it seems probable that dirty coals could be used in this way to great advantage. It is also probable that the outcrop coals used in a producer-gas plant may become as valuable as the best grades of coal used in a steam plant.

With a satisfactory scheme for the utilization of the upper and poorer grade of coal, the mines can successfully be operated and the deeper coal can be used for steaming where a producer gas plant is impracticable. For the production of power, the utilization of our low-grade and outcrop coals for producer gas seems much more promising than any other scheme which has yet been devised for their use.

heavy drags of stone slowly pulled around on a stone bed, the ore being ground under them. The motive power was a bullock and the crushing capacity of such a machine was from one to three tons per day. By this method considerable gold was taken out, which formed the foundations of the fortunes of numerous Spanish and Mestizo families.

Back in those days, according to accounts more or less reliable, the town of Mambulao, which lies on a sheltered deep-water harbor, was the second city of the Archipelago with something like 60,000 inhabitants. Today the entire municipality numbers perhaps 1500 souls.

One of the evidences of the town's former greatness is to be found in the old "Moro fort"



OLD ENGLISH MILL REMAINING ON THE CAMARINES WORKINGS.

(for protection against those venturesome Mohammedan pirates of the South) the ruins of which are still to be seen on the outskirts of the settlement.

Prior to 1894 Camarines Norte was the scene of great activity in mining among the natives, but in that year the Spanish government prohibited the industry to the natives and it was this prohibition which accounts for the present quiescent condition, now just about to be broken up.

The Nestor of mining in this district is undoubtedly Pegerto L. Somoza, a Spaniard who has resided in Camarines Norte for more than a quarter of a century. With a zeal that never flags and the enthusiasm of a schoolboy, "Don Pegerto," as he is familiarly known, has labored unceasingly for the promotion of the interests in which his faith has never faltered, notwithstanding continued years of reverses. He has, during both Spanish and American sovereignty, been a contributor to the press of articles upon the resources of his beloved adopted country. His mineral collections have been the admiration and envy of all miners and he was largely responsible for an exhibit of specimens from the Camarines, by no means to be despised, which was displayed at the St. Louis Exposition.

The following clipping from an article published several years ago in a Spanish newspaper of Manila as a contribution from Sr. Somoza gives a good insight into the flush days in Camarines Norte before "the prohibition."

"In order to give a greater number of details which may be of some usefulness to future development enterprises, we will cite some analyses and tests made, dividing them into two periods; one, of the clandestine mining which the natives used to carry on in Camarines Norte up to the year '94, the date of the prohibition, and the other, for eight years past, the European system, with more skill and capital, and therefore more scientific analyses.

"Of the first, or the mining of the native with his primitive system, we know that from the mine located on the mountain called Saitaas nang Bayang they extracted a great deal of rich mineral during a considerable space of time, the activity which that bonanza produced being so great that in the early morning the greater part of the people of the pueblo gathered beside the mouth of the mine. The women carried their different native foods for the breakfast of the miners, asking in payment for this food a piece of quartz or a handful of grit from that gouged from the heart of the vein, particularly rich. Generally they were *dalaguitas* (maidens), those who used to carry their little movable tienda of food, which the young men saw with great pleasure, and reciprocated gallantly, paying the girls with a rich fragment of quartz from which some of them, grinding it at once by hand, used to extract a half peso, a peso and at times more. We have seen one fragment of two pounds weight paid in exchange for a breakfast by a youth to a graceful maiden, which, being worked out, gave an ounce and a half. Take into account that in this class of clandestine mining generally all the miners were partners; for this reason and being prosperous they got rid of the mineral. At the side of this mine there were a number of mills *(arrastres)* moved by carabaos in order to grind the mineral. At the side of this *arrastre* they used to lead down the supply of water necessary to complete the second part of the working, which, with their *pabiric* and finally the *dulanga* they carried to a finish, cleaning up the gold of the day with this latter apparatus in order to divide it among them, sometimes in dust, and other times melted down.

"In other mines they divided the mineral taken out by means of baskets. The unit which was used for counting it is the *cazon*. Its equivalent is, on the average, one-tenth



JUDGE F. B. INGERSOLL, OF MANILA, WHO IS INTERESTED IN THE PARACALE MINES.

to perhaps one-eighth of a ton. The mineral of this mine used to give from two ounces—the poorest—up to ten, the richest. The depths at which they extracted this mineral were from 14 to 15 *varas* (a vara is 2.78 feet).

"From another mine which they used to work on Mount Bulalacao they extracted extremely rich mineral, whose average, according to the samples we have seen assayed, was five ounces to the ton at a very small depth.

"From another which they used to work on Mount Togos we saw assays which gave seven ounces to the ton.

"From other mines which they worked in the mountains of Casalogan we witnessed assays (and we still preserve some mineral from there) which gave the amount of twenty-four ounces to the ton; this mineral was extracted at a depth of forty-two feet.

"From the one of at Manauc they took out a proportion so enormous that they sold a basket of mineral, which would weigh not more than three arrobas, for $500 silver, before grinding it and just as they extracted it, a class of sales which was of ancient custom among those particular miners.

"We have seen ground a fragment of quartz from one of these mines of two pounds weight and it gave four ounces of gold. Take into account that the native generally did not work more than the heart of the vein, despising the rest.

"Some reader will argue: If there is so much gold why are the natives so poor? To this reader I am going to relate an anecdote of what occurred to me in '94. I was at the side of one of the best experts of those pueblos and he was relating to me that of the rich mineral which he was cleaning up at that time there was extracted from his mine, discovered by his father, from a single shaft of some hundred feet in depth, more than $14,000 gold. Lamenting to me that he had to work as a day laborer after having taken out so much gold, I asked him: 'But, man, thou who hast taken out so much gold from the mine which thy father discovered, why dost thou not guard it and keep thyself in thy old age from having to work at day labor?' Answer—'Oh, señor! It is true, but I had the consolation of playing up to $300 on a rooster.' The reader can deduce the consequence; they seem inseparable, mining and the vices.

"Of the second period, that is of the Europeans, we have witnessed analyses made by the engineer Mr. Simpson, whose result was from three to eight and nine ounces to the ton.

"There were other assays in the Guinobatan establishment which gave two and four ounces in two classes of mineral.

"Another assay made by the engineer Mr. Williams gave 9½ ounces to the ton.

"And we have in view another analysis of the last Spanish municipal laboratory which gave as a result the enormous figure of 5 grammes 422 miligrammes to the kilogram of mineral.

"The gold in Paracale and Mambulao is found in pockets more or less great, and disseminated in veins of crystallized quartz or in mass, generally accompanied by iron pyrites, and some-

times copper, blend, variegated copper, galena, and even with beautiful orange-colored crystals of lead chromate."

During the early '90's European mining men and foreign capital began to be attracted to the Camarines for investment. Several companies acquired concessions in Paracale and Mambulao, the most notable among them being the Philippines Mineral Syndicate, Limited, a British concern which had, however, a considerable number of shareholders residing in the Islands. It is common report that this company spent £60,000 on its quartz properties, and this can well be believed from the evidences



NATIVES WORKING GOLD IN PARACALE RIVER—MANAGER MACDONALD AND PRESIDENTE ECCO

still visible to the eye in the shape of ruined machinery and equipment scattered over the country.

Operations were carried forward on a large scale. Several different mines were opened up and expensive machinery imported from England. There seems to have been a most extraordinary combination of bad management and ill-luck for a period of several years, during which time the Syndicate managed to sink a very large sum of money.

Finally, at a time when the principal development work on the properties was well along and machinery was installed ready to stamp out golden returns, the Philippine insurrection of 1896 broke out. The English engineers in charge fled for their lives and machinery and mine workings alike fell into disuse and decay.

On Longos Point overlooking the Pacific Ocean, a short distance from the town of Paracale, a Fraser & Chalmers ten-stamp mill had been set up and today the forlorn remains of a full-fledged mining plant can be seen—the iron roof of the mill house fallen in; the timbers dropping apart; the boiler and engine scaling to pieces from exposure to tropical climate. The copper plates of the mill and the iron rods set in the timbers have long ago disappeared—carried off by vandals to reinforce and sheath their boats.

Scarcely a native in the Camarines but knows of the famous Tumbaga mines in the Mambulao district. Here may be seen the rust-covered iron of a Huntington mill, engine and boiler, pumping and hoisting apparatus—all of the most expensive make and all unfitted for use from long exposure to the elements.

Prior to "the prohibition" of 1894 the Tumbaga mines were worked by the natives and on every hand are to be heard stories of their rich stores of metal.

Not long ago the writer was talking of mining in the Camarines with an aged Filipino priest—a patriarch of three score years and ten who has spent all of his life in that region. After discussing various properties the old man observed with a sigh: "Ah, Señor, but Tumbaga was the king of them all. When I was a young man I used to work all day long with my duties at the church and then I went to Tumbaga and worked all night long in the mines.."

But it was not alone from the lodes of Mambulao and Paracale that the miners of the "European period" of the early '90's were preparing to rob Mother Earth of her treasures. The general impression now exists that prior to the placing of a Risdon dredge on the Guinobatan river in Masbate in 1905 by an American corporation gold-dredging was unknown in the Philippines. Not so. In 1896 a company of Manila Spaniards represented by Sr. Somoza constructed a small bucket dredge and put it to work in the golden sands of the Paracale river.

The dredge would be considered a Lilliputian today. Its construction was crude and it had only four or five horse power. Its capacity could not have been over fifteen or twenty cubic yards a day. It did not even handle its own dirt. This was dumped into *bancas* and conveyed to a puddling mill which still stands on the south bank of the river opposite the town of Paracale. Notwithstandng these drawbacks the dredge bid fair to reap a fortune for its owners, but for the fact that its career was nipped in the bud by the insurrection which practically wiped out all mining operations in the Camarines.

Today the dredge stands rotting on an island in the river, a ghastly monument to the untiring search for gold which has lured the Spaniard to every quarter of the globe.



PART OF THE OPERATING MACHINERY OF THE OLD DREDGE AT PARACALE.

For several years following the outbreak in '96 mining in the Camarines was dead. War followed insurrection and it was not until after the passage of the Act of Congress of July 1, 1902, embodying the new mining law for the Philippines that there were any signs of a revival of interest.

The local representatives of the old Philippines Mineral Syndicate began to take steps for saving what they could from the wreck. A German Syndicate which had a large Spanish concession known as "La Candelaria" began to bestir itself. American prospectors drifted into the Camarines and made locations.

At first there were symptoms of trouble due to a conflict of interests as between rights acquired under the old Spanish law and those secured under the new American law. Sr. Somoza was an active figure in smoothing out these differences. So was Francisco Eco, a good type of the intelligent and progressive Tagalog of the provinces, formerly *presidente* of Paracale and now hemp-buyer in that section for the well-known firm of Stevenson & Co.

Mr. H. D. McCaskey, formerly chief of the Mining Bureau, in his last Annual Report has the following to say regarding mining conditions in the Camarines.

"In Camarines Province the Spanish concessions upon the extensive gold deposits in the districts of Paracale and Mambulao have been largely relocated by American mining men under present laws and without friction with the former concessionaires, and some work has been done in the reopening of abandoned shafts and in preparation for future systematic development. The important ore bodies of this district are reported to be contact deposits between crystalline schists and diorite, and to be well defined so far as uncovered. The contact is reported as traced for twenty miles, and along this all mining in this field has been done. Two vein systems intersect each other through the district approximately at right angles, the enrichment at some intersections having been reported upon as developing exceedingly high values. The strike of the most marked vein outcrops varies between 5° to 40° east and the dip is reported to be southeast. The veins are reported to be one to eight feet wide and the vein filling to be quartz. Deep mining will probably involve pumping expenses of no mean consideration, but it is understood that much valuable ore may be taken out before this expensive stage of mining is begun. It is fully believed that the deposits are worth the attention of competent mining engineers, retained by sufficient capital to work these mines; but, in the meantime, a preliminary step will be taken this year in a careful study of this field by the detail of Mr. Eveland, geologist, to the work of a reconnoissance and the preparation of a general report upon the ore bodies themselves, and possibly by the further detail of Mr. Maurice Goodman, field assistant, to a careful survey of the placer fields of the Paracale and Malaguit rivers. Reported assays from this district have averaged $20.92 in gold to the ton for the "San Mauricio," a representative group of claims covering deposits of partially refractory ore, and this for a large amount of systematic sampling reported by five different mining engineers Assays of the 'Tumbaga,' a free-milling gold-quartz vein upon which a ten-stamp mill will probably be erected in February of next year, have given exceedingly rich returns, but

as the sampling has been less carefully done upon this vein it would serve no good purpose to quote values here.

"The ores are described as sulphides of iron, copper, lead, and zinc, complex auriferous smelting ores in part and in part suitable for milling and cyanidation or chlorination. The placers have yielded important amounts of gold in the past, some of the nuggets being unusually large.



OTHER VIEWS OF THE OLD DREDGER ON THE PARACALE WORKINGS.

While it may be somewhat doubtful whether sufficient rich placer ground remains for panning or sluicing methods, recent samples of gravel from the river beds indicate that dredger work here would pay. The average of nineteen samples of gravel recently taken by Mr. Robert Lienau from the Malaguit River and examined by Mr. H. M. Ickis, field assistant, shows a value of 16 cents to the cubic yard. It is anticipated that, notwithstanding mistakes that may have been made in the rather extensive development of the presumably rich ore deposits of this district in the past, the gold ores of Paracale and Mambulao, together with the placer fields are most decidedly to be reckoned with in future work."

Today the most prominent figure in the mining district of Paracale and Mambulao is A. J. MacDonald, the representative of a considerable number of Americans and Filipinos who have interests there. MacDonald is a typical American pioneer. Schooled in the mining districts of Washington and British Columbia, then a volunteerr soldier in the army which occupied the Philippines, later chief of the secret service of the Customs service and again special Customs agent on hazardous duty among the Moro smugglers of the Southern Islands, his is an interesting career. For the past three years he has lived continuously in Mambulao and Paracale, being at times the only white man there.



H. L. BECKJORD AND S. W. SILDEN WHO ARE INTERESTED IN TAYABAS FIELDS.

Recently but little has been heard by the general public of mining in the Camarines. A considerable number of Americans and Filipinos have claims there, but they have done but little more than prospect and keep up their assessment work. The need of large capital to take hold has been recognized and persistent although conservative efforts have been made to attract it.

The first tangible fruits of this work of promotion is to be seen in an enormous gold-dredge which is now being constructed for use on the Paracale river. After long negotiations the Americans and Filipinos who control this tract of placer ground succeeded in interesting a group of New Zealand capitalists, who about a year and a half ago sent over a mining engineer to test the deposits with boring apparatus. This expert spent about four months on the ground making tests as a result of which the New Zealanders entered into a contract with the owners of the claims to dredge them on shares.

New Zealand is the home of gold dredging, and the fact that some of the leaders in this class of mining are giving such material evidences of their faith in the district speaks volumes for the future of this class of industry in the Camarines. The dredge, which is by far the largest set up in the Islands, has a daily capacity of 2,000 cubic yards. The hull is 113 feet long by 29 ft. 6 inches wide and is 5 feet 6 inches deep at the bow and 8 feet 9 inches at the stern. The dredging ladder is 52 feet long. About 70,000 feet of Oregon pine has been used in the construction of the barge.

Specially constructed sluice boxes, 80 feet long, have been placed on the dredge to save the gold-bearing black sand found in the Paracale river.

The dredging machinery arrived from New Zealand last January and was at once forwarded to Mercedes, Ambos Camarines, where the dredge is being constructed under the supervision of Mr. Joseph Pearson an expert dredge-builder of Dunedin, New Zealand. Mercedes was selected as the site for the construction work by reason of the superior advantages it offers over Paracale in the way of transportation facilities from and mail communication with Manila. After being completed the dredge will be towed from Mercedes for some twenty miles up the coast to the mouth of the Paracale river.

Although the machinery came from New Zealand, all of the lumber for constructing the barge and all the hardware supplies and provisions have been purchased through local dealers in Manila at an outlay of many thousands of dollars. Outside of a few skilled mechanics, experts in this class of construction, only native labor is being used in building the dredge.

The dredge is nearing completion and it is expected that it will be chewing up dirt in the Paracale river not later than the first of next July.

While the dredge for the Paracale river is the first visible result of the consistent promotion work carried on by the claim-owners in the Paracale and Mambulao district, it is prophesied that the present year will see other important enterprises under way not only in placer but in lode mining.

The old "Candelaria' concession formerly held by a German syndicate is now controlled by Dr. J. R. McDill, the well-known surgeon of Manila, and a party of friends. Dr. McDill is now in the United States and among other business to have his attention there it is commonly reported that he will close a deal which will mean the opening up of "Candelaria" on a large scale.

Without discussing technically the richness and extent of the mineral deposits of Mambulao and Paracale, it is apparent even to a novice that the whole country is heavily mineralized. There are showings everywhere. Excepting tin and platinum practically all the better known minerals are found. There are even large deposits of Kaolin and mineral paint.

The geological formations of this district are almost entirely eruptive and consist of a coarse granitoid gneiss, except in a limited section which carries sedimentary limestones. The veins run generally in a North-east and South-west direction.

The whole country is thickly wooded, furnishing an abundant supply of fuel and timber. There is also plenty of water for milling as well as for domestic purposes.

There are no difficulties of transportation, since the most of the properties which are known to be valuable are close to the seacoast. At Mambulao there is a fine deep-water harbor and the Malaguit river is navigable for inter-island steamers of moderate draft up to the settlement of Malaguit, less than a mile distant from the town of Paracale.

TAYABAS OIL FIELDS

The oil fields of Tayabas province, Island of Luzon, are situated in the Bahay river valley, near San Narciso on the Bay of Ragay, or on the extreme end of the Peninsula of Tayabas, and can be reached by taking steamer at Manila for Catanauan, Tayabas, approximately two hundred miles south of Manila, and then by travel overland or preferably in a sailboat to the oil fields—a distance of probably fifty miles.

Quite a good deal of development work has already been done by the several claim holders,



NATHAN O. NOAH, WHO IS INTERESTED IN TAYABAS PETROLEUM.

especially by Messrs. Tilden and McDaniel. Mr. McDaniel has drilled a hole to a depth of 127 feet, over a hundred feet of which has been cased with iron pipe four inches in diameter.

On a recent trip to these oil mines a ten-gallon zinc can was filled with the oil standing in the hole above-mentioned and brought back to Manila for testing purposes The oil in this pipe is simply the seepage from the oil sand, the hole not yet having been drilled deep enough to strike the main reservoir owing to the drilling machinery having broken down. All indications point to a fair quantity of oil in that section of Tayabas province.

Recently Mr. McDaniel made a test of this oil just as it was brought from the oil wells, without any refining process whatever, in the Agricultural bodega of Castle Bros.-Wolf & Sons in Manila. This oil was used as a fuel in a Fairbanks Morse engine, known as the "Jack of All Trades," the test lasting four hours, and furnished splendid power for operating machinery during that time. This statement can be verified by Captain Thomas Leonard, Mr. F. N. Bungey and Mr. N. E. Thompson of the Bodega, who were present during this test. This simply serves to show the possibilities of Tayabas oil, which also contains a large percentage of illuminating oil and has been tested in its natural state by burning it in a small tin lamp without globe or chimney, in an open room, the lamp holding 1½ gills and burned for six hours without refilling.

An analysis of the oil from the Bahay field (the sample being taken from the first oil sand strata at depth of 62 feet) made by the Bureau of Science (the Government Laboratory) in Manila, during April 1906, showing the following report on analysis of crude petroleum—specific gravity of original sample being 30° fractional distillation.

A 90°-150° C—6% of 49° Bl.
B 150°-300° C—67.5% (B Refractionated)
BI 150°-185°C—20% of 44° Bl.
BII 185°-125° C—28.5% 35° Bl.
BIII 250°-300° C—19% of 27° Bl.
C. Fraction not boiling at 300° C was redistilled in vacuum, (6 to 8 mm pressure)
170°-300° C—23% of 18° Bl.
D Residue of tar, etc.—3%

(Signed) HERBERT S. WALKER,
Analyst.

The Bahay oil fields are easily accessible and the best of water transportation is available, which is well sheltered from storms and affords good protection to vessels. A road and pipe line can easily be constructed from the oil mines to the sea coast, a distance of about two and one half miles, the elevation being something like 130 feet, which is amply sufficient for the laying of a gravity pipe line from the oil wells to the coast, very little clearing of brush and trees being necessary.

Oil in large quantities is certain to be found in the Bahay river valley in Tayabas, and will undoubtedly pay good dividends on capital invested in this enterprise, as the Philippines alone furnish a tremendous field for the consumption of oil, both illuminating and for fuel purposes, particularly in furnishing power for operating machinery. Following is a list of some of the holders of oil claims in the Bahay river valley, Tayabas province:—

E. W. McDaniel	H. W. Pickrell
Olney Bondurant	J. C. Muerman
C. G. Clifford	W. W. Weston
John H. Finnegan	Major J. B. Murphy
E. C. Stelton	E. W. Ladd
Geo. K. Armstrong	U. S. Vincent
N. O. Noah	G. W. Parsons
Mills Dean	C. J. Cooke
S. W. Tilden	H. L. Beckjord
E. M. Wilcox	S. S. Brown
J. F. Dresser	William H. Rookey
C. Skattebol	M. Herman
Hardee M. Wyatt	Glenn W. Parks
A. Heise	C. A. Brinkley
Harry Milord	Claud Dobbins
Harry Coleman	Rufus McCrea
T. L. Hartigan	Chas. H. Crooks
M. L. McLain	A. C. Monks

Wm. Mason.

MINERAL DEPOSITS OF ILOCOS NORTE

In the northeasternmost part of Luzon there is a district bounded on the west by the China Sea, on the east by the Caraballo del Norte Range, and on the north by the Formosa Straits, which bids fair in time to become a very rich mineral region, and this district will probably be known not for its gold or copper, though there is undoubtedly some of each of these minerals, but through its non-metallic minerals: asbestos, phosphate, mica; and, in all likelihood, it will yield gem minerals. Ilocos Norte is mountainous over most of its territory. These mountains are very high along its eastern boundary between Cagayan and Ilocos Norte, with considerable foothill country to the west and a coastal plain varying from 1 to 7 miles in width, being a very irregular strip. The Caraballo range trends north and south and, likewise, the minor ranges to the west, with, of course, occasional exceptions here and there, spurs and offshoots, which tend to have an east and west trend, the most notable case being the long black range running eastward from Cape Bojeador. The mountains of that part explored by me are not high, 2,000′ being the limit, but the relief is quite pronounced. In reality there is a plateau of this height which extends from Pasuquin northeast to Bangui. This plateau though not over 2,000′ high is deeply cut by several rivers, thus giving a pronounced relief to the topography. The principal rivers are the Laoag and the Bacarra, flowing west into the China Sea, and the Bamban northward into Formosa Straits, near Bangui. None of these rivers are navigable for large craft, and the Laoag is the only one large enough even for *Virays*.

Good harbors are scarce on this coast. In the typhoon season it is very dangerous, there being no entirely safe shelter on the whole west coast north of Subig Bay. In all ordinary weather good anchorage may be found in Bangui Bay during the southwest monsoon. In the northeast monsoon the north coast is out of the question. Of the harbors on the west coast there are only three which are used, the Dirique, Currimao and Salamague, the last named the best. All of these are reef-bound and have to be entered with the greatest caution.

The climate of Ilocos Norte is considered very healthy, being much cooler here than in most coast provinces, and its seasons are quite regular. In the time of the northeast monsoon the north coast is very windy and cool. During this season the city of Laoag, capital of the province, is very healthful and pleasant to live in. The word Laoag in the Ilocano dialect means blue skies.

Geologically the province of Ilocos Norte is quite distinct from any other I have been in or of which I have any data. It is distinctly a metamorphic area, and so similar in many ways to areas in the California coast range that anyone familiar with the latter could very easily persuade himself that he was really not in the Philippines at all, but wandering over the hills near Berkeley (Cal.). A simple statement of the formations in the order of their probable position will be sufficient in an article of this kind. From above downward we find the following formations: Raised coral reefs, marl beds, these two belonging to the Pleistocene; calcareous sandstone, coarse-grained sandstone, a brecciated jasper formation, then follows an unconformity, below which are eruptive conglomerates and tuff deposits, granulite dikes; bordering the eruptive conglomerates and the granulite is a belt of schistose rocks; the basal formation of the whole district is a dark, fine grained, in places slightly porphyritic, igneous rock, which for purposes of convenience we shall call a dolerite.

The asbestos deposits occur in the last named formation, the manganese as veins in the eruptive conglomerate formation. In the schistose rocks are found various minor products, namely, micas and talc, which may prove of future value.

It is not to be understood from this enumeration of formations that the whole succession is to be found continuous over the whole area. Indeed, uplift, folding and subsequent degradations have wrought great havoc in the stratigraphic column, and it is only by piecing together bits of information here and there that we have been able to reconstruct a record of the probable past events.

Mineral Resources.—Not until within the last year or two has any systematic prospecting been done in this province and only within the last year has any development work been carried on. And to my knowledge no geologist or mining engineer had ever visited this region previous to this time. It was long known, however, to Señor Lallave, who owns several large estates near Bangui, that mineral fibre existed on his land, though he never fully appreciated the fact. The deposits which are being developed there now and which may prove very valuable assets to the province are as follows:

Asbestos.
Manganese.
Granite—building stone.
Mica and talc.
Felspar and quartz deposits.
Mineral paint—ochre.
Apatite.

Besides these there are remote possibilities of gem minerals being found. There have been found also some poor specimens of opal; also the indications appear good for the discovery of tin.

Asbestos.—As yet no 1st-grade asbestos, or chrysotile, has been found in workable quantities, though there is every reason that such will be obtained after more development work. Owing to an erroneous and entirely misleading quotation purporting to have come from the Bureau of Science and appearing in one of the Manila dailies, and quoted in this paper, inquiries have been coming into us from several European countries. To straighten out the matter I shall quote from my report (at that time confidential), to the Chief of the Division of Mines:

> At present I have to say that while there is not one ton of asbestos in sight (I am using this in the sense understood by engineers) in the whole region visited by me, the indications, moreover, seem quite good for getting out in time a fair grade of asbestos and in goodly quantities.

The variety which is being taken out now is the amphibole anthophyllite and tremolite, and is characterized by having its fibres parallel to the walls of the vein. These fibres vary from a fraction of an inch in length to a foot or more. They vary also in color, from a dirty yellow to silky white, and in hardness also. On the Dungan-Dungan Estate, in an estero of the Baruyen River, one finds the nearest approach to the chrysotile asbestos, but there the fibre is irregular, being found in pockets and along shear zones in the serpentine. It is unfortunate that at the time of my visit floods and land slides had almost completely obliterated the work Mr. Burdette had done at this locality.

Indications of asbestos have been found at the following localities:

Baruyen Hill—schist area.
Baruyen Valley.
Dungan-Dungan—serpentine.
Baruyen Valley—very promising.
Caraon River—schist area.
Near Pasuquin.
Dalumat.
Near Pasuquin—schist area.

In the most prominent asbestos regions, as the Thetford, Canada, the serpentine areas have been proved to be the most productive and besides are more easily worked.

Manganese.—Manganese, in the form of the oxide, pyrolusite, often mixed with limonite, has been found in a rather limited area adjacent to the barrio of Nagpartian. We find this in its most typical occurrence. All that I have yet seen comes from an *eruptive conglomerate* mass, which forms prominent black ridges on the north coast and about two miles south of Nagpartian. The manganese had its origin in small veins and pockets between the igneous boulders of the mass, but has since been con-

THE BENGUET CONSOLIDATED MINING CO.

The best showing in development work and in returns for capital invested in the Benguet mining district up to the present time is that made by the Benguet Consolidated Mining Co., operating on Antimok Creek about five miles from Baguio. A three-stamp mill and a sixty-ton cyanide plant are in continuous operation and another three-stampmill has arrived. In all, the company has invested in machinery and other equipment over $55,000 and this will be added to from time to time as the work expands. Over 1,000 feet of tunneling has been done and a large body of ore uncovered.

The natural conditions at Antimok are most favorable to the economical development of the Consolidated properties. The ore is carried from the side of the mountains by gravitation, the mine drains itself and the water available for power is unlimited. Plenty of timber is available and the climate of the Benguet Hills is ideal.

The result of the operations of the company is a nice bar of gold every week and there is every indication that this will continue indefinitely and increase in volume as the facilities for milling are extended.

The most pleasing feature of the progress made by the Consolidated is the fact that from the day that the prospector put his pick in the ground for the first time the development has been most wisely directed. Practical mining men have been in charge and no money was wasted. Before any mill was thought of, sufficient ore was made available to warrant the investment and every outlay considered from a practical mining viewpoint. The result is a highly developed property and a great future for the pioneer company that has demonstrated that mining in Benguet gives promise of large returns for capital.

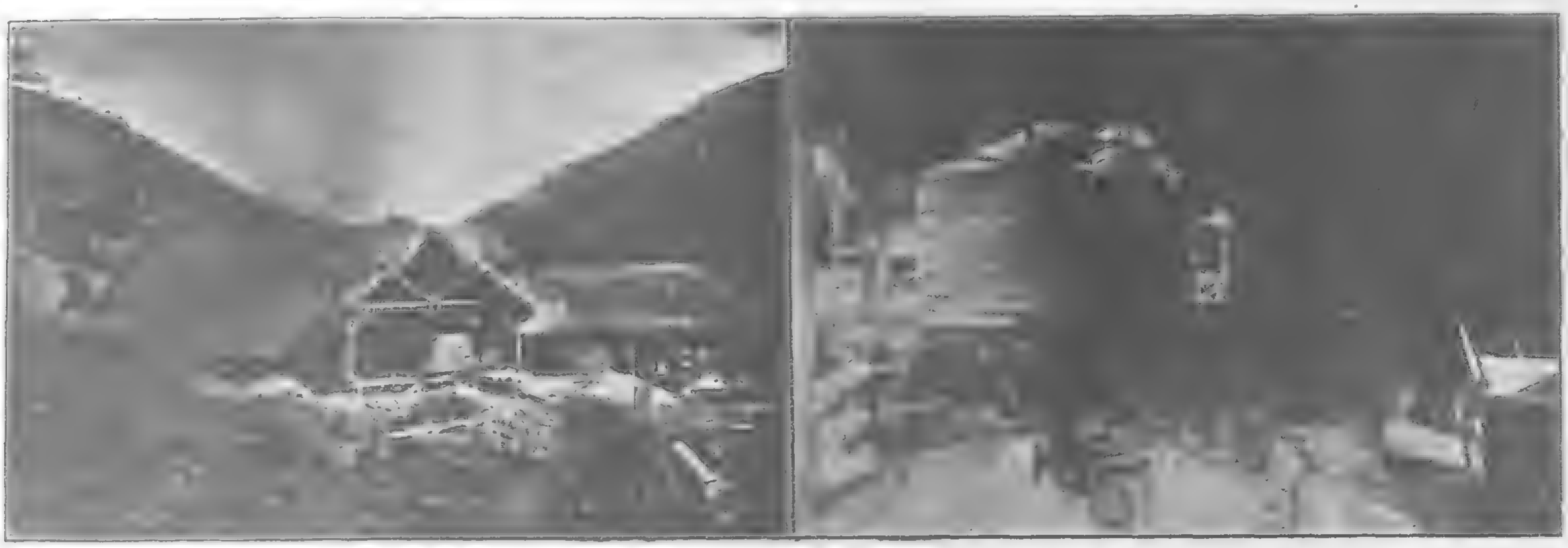
It has long been known that gold existed in considerable quantities in the mountain district of Benguet, but up to the time of American occupation, operations were confined to workings by Igorots on such a small scale as not worth considering in the world's production. Their methods were limited to the most primitive and their necessities so small that the yield was insignificant.

In the early days of American occupation the reports of good ore brought in by American prospectors attracted attention but resulted in but little exploitation. The difficulties, particularly that of transportation, which was then only possible over Igorot trails and which consumed over a week's time in hard travel from Manila to Baguio, practically eliminated activity in development. The completion of the Benguet road has served, however, to obviate this difficulty to a degree, but the transportation of supplies is still limited to bull carts and mule teams from Dagupan, the present terminal of the railroad. The extension of the railroad 25 miles to Camp One which is now under way and will be completed next February will serve to simplify this problem wonderfully as it will leave but 22 miles for hauling. The prospect for a railroad through to Baguio is very bright and if consummated will make the mining district of Benguet as accessible as any mining camp in the world.

The gold is found entirely in quartz in the Antimok mining region and more or less free milling. No bonanza values have as yet been discovered but the ore available is of sufficient value to make the outlook for very profitable mining sufficiently bright to justify further investment. To properly treat the ore and secure the greatest possible values from it, it is necessary to install cyanide plants. The first up-to-date mill and cyanide plant was installed by the Benguet Consolidated Mining Co. Mr. M. A. Clarke, who provided the first grub-stake and sent a force of prospectors into the Benguet hills, is the president of this enterprising company. He has never faltered in his faith in the future of the mining industry in the Philippines and by judicious investment and wise direction it might be said that he is responsible for the demonstration that gold mining in the province of Benguet is a paying business proposition. He took the initiative in the organization of the Consolidated and financiered the new company until it was placed on a self-supporting basis.

The Consolidated took over the claims owned by Mr. Clarke and those of the original prospectors, Nels Peterson and H. C. Clyde, the two latter being the pioneers who blazed the trail through the hills to the Antimok region and are now enjoying well earned prosperity. The development work has been continuous since 1899 and shortly after the organization of the company the outlook justified the purchase of a modern stamp mill and the installation of a cyanide plant. A three-stamp and a sixty-ton cyanide plant were installed last year and in September the mill began operations.

As the returns came in and the development work continued sufficient ore was blocked out to warrant the duplication of the plant. This



CYANIDE PLANT OF THE BENGUET CONSOLIDATED MINING COMPANY, ANTIMOK DISTRICT, BENGUET.

centrated by natural processes and where it is being opened up now is found as a *blanket* deposit consisting of entirely loose, more or less rounded nodules in a matrix of very red, ferruginous soil.

As to the workable quantity of this ore we cannot as yet predict. The surface indications are quite wide spread, for wherever one goes ovet this eruptive mass he will find these pyrolusite nodules scattered over the surface.

At present one company is opening up a small surface deposit between two limestone hills about ¼ mile from Pt. Negra, where if the deposit prove to be of any extent and depth there will be no difficulty in getting it aboard ship.—WARREN D. SMITH.



METCALFE A. CLARKE, PRESIDENT OF THE BENGUET CONSOLIDATED MINING CO. OF BENGUET AND PROMINENT AMERICAN MERCHANT OF MANILA. THE FIRST AMERICAN TO SUBSCRIBE TO A GRUBSTAKE.

mill arrived in Manila the other day and is now on its way to the mountains.

Many improvements have been added from time to time it being the purpose of the company to make the plant first class in every particular. The building in which the plant is installed is of iron construction. All the mine tunneling has been fitted with steel track for the ore cars. At the present time a superintendent's house is under construction and an electric light plant is now on the way from the United States.

While it is a fact that the venture necessitated the expenditure of a great deal of money, it has been fully demonstrated that the proposition is a sound one. No stock is on the market and the holders are quite satisfied with their investment.



THREE-STAMP MILL IN OPERATION ON THE BENGUET CONSOLIDATED MINING CO.'S PROPERTY.

The following are the officers of the company: President: Metcalfe A. Clarke; vice-president and treasurer: Judge Daniel R. Williams; secretary: J. H. Sefert; directors: Metcalfe A. Clarke, Judge D. R. Williams, J. H. Sefert, John W. Haussermann, Nelson Peterson and H. Clay Clyde. Clyde M. Eye, E. M., is the superintendent.

THE KELLY MINERAL GROUP

The Kelly group of claims is situated about five miles in an easterly direction from Baguio, in the famous Antamok mining district. The group adjoins the Benguet Consolidated and the Bua Mining Company's properties on the west.

The formation of the district is diorite. In all, about 1500 feet of development work can be credited to this property, including tunneling, raising and cross-cutting.

The lode has been cut in half a dozen places covering a distance of more than 2000 feet. The greatest depth obtained is about 200 feet. The lode is about 20 feet wide and lies between two well defined walls. The ore will average about $5 a ton, gold, while some of it runs as high as $150 a ton. A mill test made of this ore showed 40% free-milling, the balance yielding very readily to the cyanide process, giving a total extraction of more than 80%.

The natural advantages of the location of this group of mines could not be excelled. Water is plentiful for power and can be harnessed at little expense. The most suitable timber for mining purposes is plentiful and easily available in that vicinity.

A careful investigation of the ground demonstrates that a depth of 1000 feet can be obtained by tunneling along the trend of the vein. With a mill capacity of 50 tons per day the ore can be mined and milled for $1.50 a ton and at the present time there is enough ore in sight to run such a mill for a number of years.

It is conceded that this group of mines which is owned by Mr. James Kelly is one of the most valuable in the Benguet region and perhaps there is no other group upon which a greater amount of practical development work has been done with a view to uncovering the hidden mineral wealth. Once capital is attracted to this region the development of the Kelly Group will not be long delayed.

LUBANG MINING DISTRICT

The district known as Acupan is south of Antamok and about five miles south of Baguio; the Butuan district, about seven miles south-east of Baguio, and the Lubang district, on the southern boundary of Benguet, comprise the balance of the real mining properties to which reference has yet to be made. In all three districts much has been accomplished, although lack of capital has greatly hampered all the undertakings. The prospectors have confined their operations primarily to assessment work and applying themselves so that the greatest possible uncovering of the body of ore might result without neglecting to conform with the exceedingly stringeut clause of the mining law that requires the full value of assessment work to be done on each claim separately. This distribution of effort has been most discouraging. Only the minimum result is thus accomplished where, had these Argonauts been able to cooperate and direct all their energies to the development of one claim for the benefit of all, some substantial showing could now be made.

The Lubang claims are of special interest since they lie on the south fringe of the big mineral belt which, defined for the purpose of this article, includes an area of over 400 square miles and includes the Benguet and Lepanto districts. This group of claims are situated in the foothills near the south end of the Benguet road and ten miles from the pueblo of Binalonan. The camp is on the Tuboy river. The American prospector was first induced to inspect the territory on account of the indications of old Igorot workings. The first locators were Messrs. Horn and Lambert, and since 1901 development work has been progressing slowly but nevertheless steadily and with satisfactory results.

On the Anaconda, Mr. Horn's claim, a 300 foot tunnel has been made and a lead 35 feet wide of refractory ore developed which averages from $9 to $16 a ton.

The Olympic, owned by Mr. Lambert, has over 400 feet development on a lead fifteen feet wide and averaging $14 a ton.

The Never-Sweat claim of the same group, owned by Mr. Hann and others, has a tunnel 200 feet long on a lead 30 feet wide. The ore is very similar to that of the Anaconda and the Olympic.

There is plenty of wood and water at this camp and in fact it is not necessary to go outside any of the prospects to secure all that is necessary for development work.

In connection with this group it might be said that, besides the refractory ore, one of the richest free-milling specimens in the Philippines came from one of the claims of this group.

Among the claims in addition to the ones mentioned, is the Rough Rider, owned by L. O. Hibberd, one of the most promising in the group. Messrs. Straight and Misner, two well-known mining men who have been identified with the development of the resources of the north region of Luzon, have also located here and are satisfied that they have made no mistake.

INTERESTED IN MASBATE MINES

Mr. B. A. Green, auditor for J. G. White & Co., has a number of valuable claims in Masbate and is greatly interested in the development of the district.



NELSON PETERSON, ONE OF THE PIONEER PROSPECTORS OF BENGUET AND HEAVY STOCKHOLDER IN THE COSOLIDATED MINES.

THE BUA MINING COMPANY (LIMITED)

The properties of this Company are situated in the mining district of Antamok, Province of Benguet, P. I., on the great mineral belt which runs in a northerly direction throughout the Island of Luzon, but which has not been explored to any extent, except in the Provinces of Nueva Ecija, Benguet and Lepanto-Bontoc.

Systematic development work was begun by the Company in February, 1905, and is still being carried on, results up to the present being highly satisfactory. Seven distinct ledges, of a size and value sufficient to warrant the erection of milling plants, have been opened up, as well as numerous others which show good indications but are not sufficiently developed at present to judge of their value. The method of development has been by tunnels driven on the ledges, at or as near to the river level as practicable, upraises and crosscuts being driven to prove the ledge and explore the walls, both foot and hanging, for possible blind leads. The height of the mountains above river level giving immense backs (ore above tunnel level ready for stoking), the sinking of expensive shafts will not be necessary for some years.

The country rock on footwall is a diorite and on the hanging wall it might well be termed a felsite.

All the veins explored so far are apparently true fissures, having a well defined gouge on both walls. The strike and dip is the same in each, the strike going east and west and the dip south, but the character of ore differs greatly, though the veins are parallel. The ledges deserving espeeial mention are "Buckhorn," "Sunrise," "Dorothy," "Gomok foot wall," "Gomok hanging wall," "Ultimo," and "Crown point."

On the Buckhorn 1,000 feet of development has been done, and there is approximately 10,000 tons of ore in sight of a value of $8 per ton by fire assay.

Sunrise: 218 feet of development. Approximate quantity of ore in sight, 3,000 tons; assay value $6.18 per ton.

Dorothy: 140 feet of development. Vein ten (10) inches wide; assay value $103.00 per ton.

Gomok: total development on hanging and footwall ledges 1,100 feet. Ore developed in footwall ledge 9,000 tons approximately; average assay value $8.24 per ton. Ore developed in hanging wall ledge approximately 40,000 tons; assay value $5.03 per ton. This ledge is fourteen (14) feet in width, and is a calcite or calespar which a slight percentage of carbonate of manganese has given a beautiful pink tint.

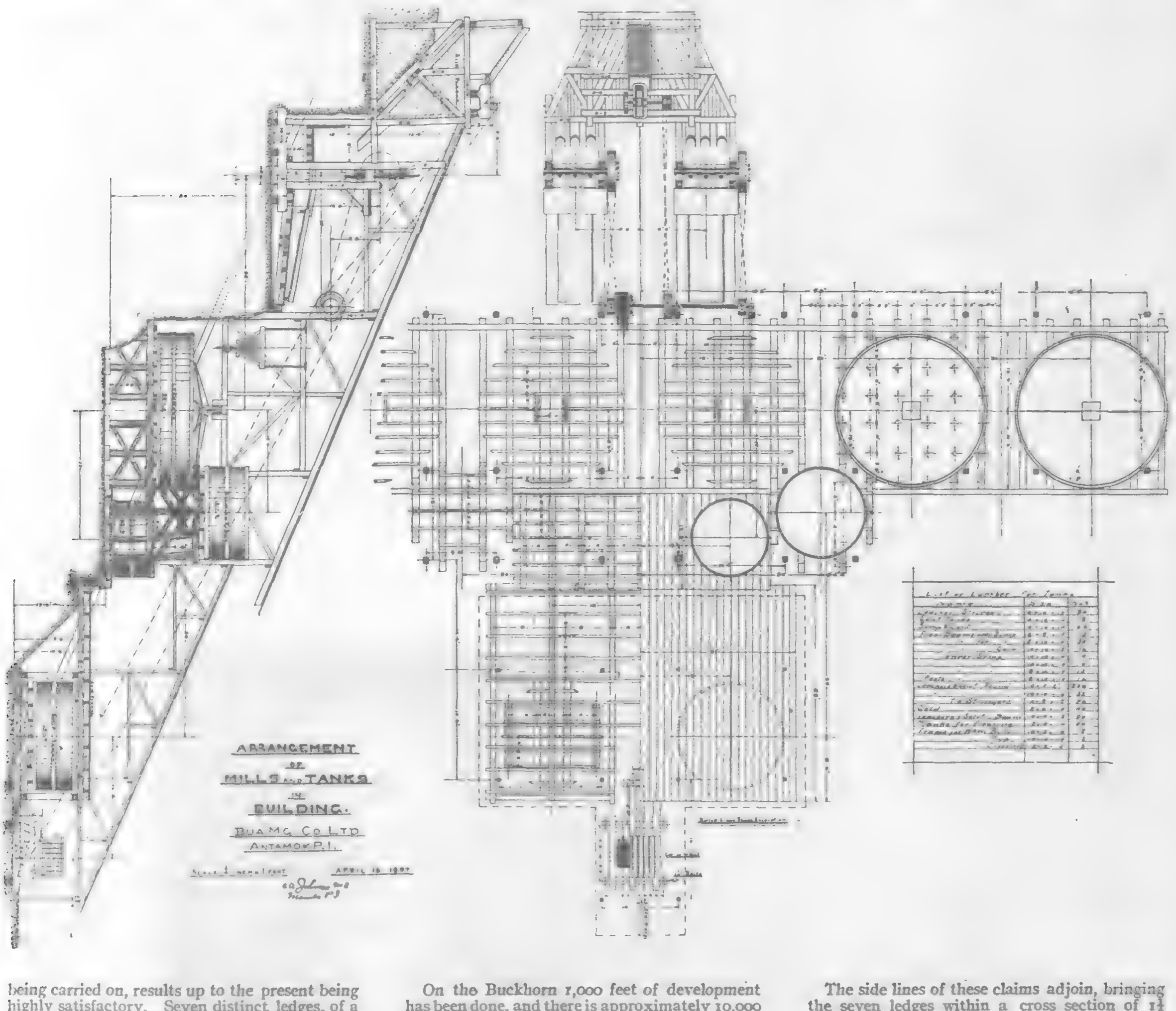
Ultimo: Ore in sight approximately 2,400 tons; assay value $18.54 per ton. This vein is remarkable in that it carries a large per cent (34%) of di-oxide of manganese, in which a considerable part of the gold value of the ledge is contained in a free state.

Crown Point: This ledge is six (6) feet in width and assays $10 per ton, but quantity of ore in sight has not been proved.

The side lines of these claims adjoin, bringing the seven ledges within a cross section of 1¼ miles, thereby materially lessening the cost of extraction of the ores.

In addition to the claims mentioned, a considerable amount of development has been done on the other claims owned by the Company, which will bring the total deveolpment up to nearly 8,000 feet.

About 75% of the values contained in the ores can be extracted by amalgamation, and the remainder by the McArthur Forrest cyanide process. A milling and cyaniding plant of 50 tons per day capacity is now being installed for treatment of the ores, the mill being driven by water power obtained from the Antamok River. The ore from the claims at greatest distance from the mill will be transported thereto by aerial tramways, actuated by gravity.



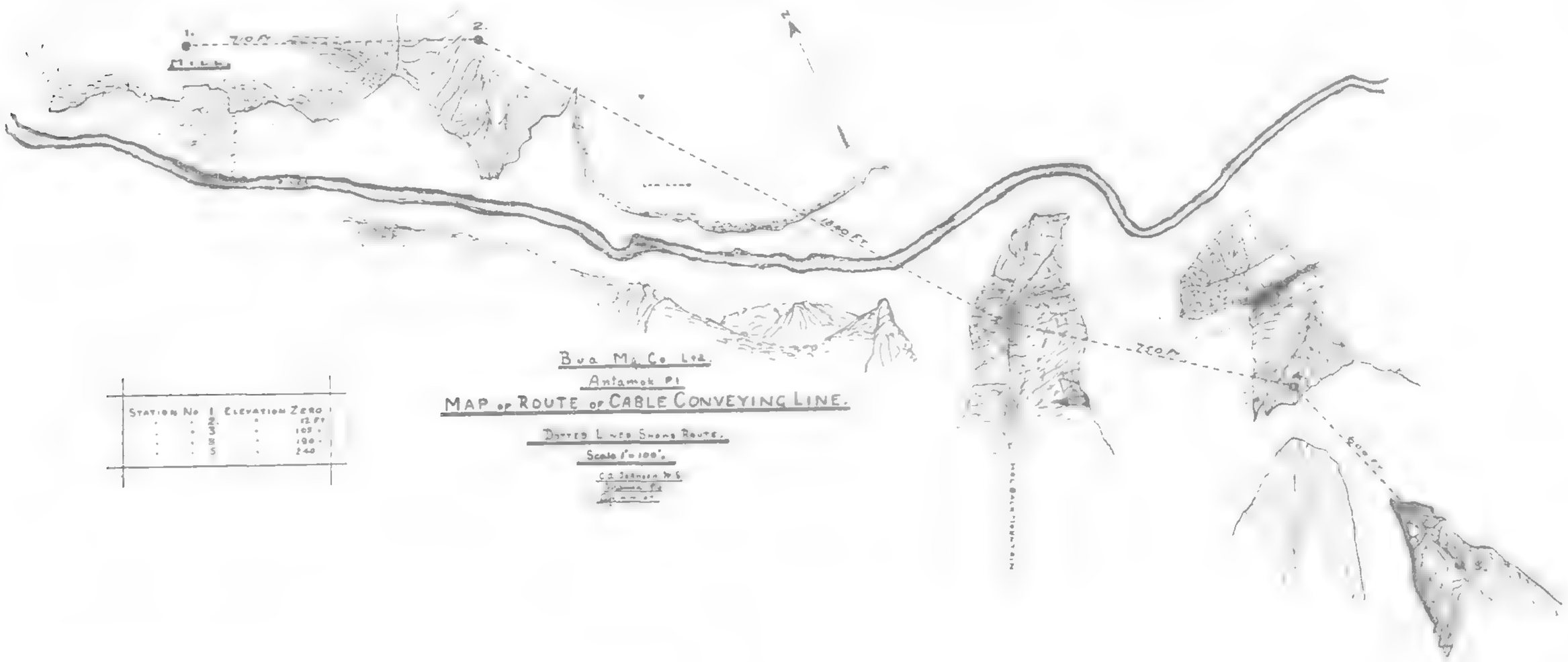
The Bua Mining Co's group of mining claims makes one of the most promising mining properties in Benguet. In all there are 32 claims, with seven well defined pay ledges, the ore running all the way from $5 to $25 a ton. The development work has been under the supervision of experienced mining men and over 5000 feet of underground tunneling has been accomplished. The longest drift is about 400 feet.

In two instances shafts have been sunk below the main level and extend below the creek level. The ore in these shafts showed an improvement in the quality of the ore as compared to the main body in the backs which contain an immense volume and extends back for over 900 feet. The presence of water interfered with the work below the levels and the development was confined to the main body of ore more easily exposed.

The Bua Mining Co. has secured control of this property and are making extensive preparations for developing the property. Two three-stamp Hendy mills and a cyanide plant have arrived from the United States and will be immediately installed. There is abundance of water power in Antamok creek to run 100 stamps and plenty of suitable timber, so that the company begins active operations under the most favorable auspices.

The directors of the company are:

T. Colston Kinney, president; Richard T. Laffin, vice-president and general manager of the Manila Electric Light and Power Co.; and H. P. Whitmarsh, mining director and manager of the Benguet Commercial Co., Baguio, Benguet.



THE HARTWELL CLAIMS

Among the first claims located in the Benguet country were the so-called "Hartwell Claims" on Kius Hill, about twelve miles south of the pueblo of Baguio.

The locator, Jack Hartwell, was one of the most reliable men that ever came to the Philippine Islands and his untimely death, about two years ago, was felt by all the miners in the Islands, who appreciated him for his honesty, ability and sterling worth. He had had much experience both in America and South Africa but had to leave the latter country on account of his health.

The claims located by him were six in number, running from the Butuan Creek in a northerly direction for about a mile. They are known as the

"PROSPECTOR"
"HOPE"
"SCHOOL-MA'AM"
"BUTTE"
"MONTANA" and
"COLOR SERGEANT"

and give evidence of being among the most valuable claims in the Islands.

The "HOPE" claim is in its nature more or less of a placer claim and consists evidently of a hill top which has toppled over where the plane is located. It forms a bank of from 15 to 30 feet in thickness, and assays throughout at from $10.00 to $20.00 gold a ton.

The other claims are located on the ledges which run through that part of the country, and all show very high assays.

Hartwell, who was a very conservative man, spent the greater part of his time searching for the ledge from which the toppled-over hill had come. One day he notified the parties interested with him that he believed he had located it. Immediately afterwards word that he was down with the small-pox reached Manila, and before his partners could get any communication from him he died he had caught. The small-pox while making a visit about sixty miles east of his mines to give an opinion on the worth of some claims there situated. With his death, a great part of the work on the mines was stopped, but sufficient has been done to warrant the patenting of the same, and the mines are now surveyed by the mineral surveyor and patents for the same are about to be issued from the Bureau of Lands.

The proposition is a free-milling and cyaniding proposition, about half the gold being extractable by amalgamation.



RICHARD T. LAFFIN, VICE-PRESIDENT AND GENERAL MANAGER OF THE MANILA ELECTRIC RAILROAD AND LIGHT CO. AND VICE PRESIDENT OF THE BUA MINING CO. OF BENGUET

THE COPPER KING MINING GROUP

The Copper King group of mines comprises the most important part of the district known as the Bassa, which lies about six miles south of Baguio and in the immediate vicinity of the Benguet road. In point of transportation facilities this group has an advantage over all others in the Benguet mining belt. With the construction of the proposed railroad to Camp One it will be an easy matter to bring in supplies and get the ore to the port of Dagupan or San Fernando de Union.

As a whole this group of claims is featured by peculiar mixtures of ledges, some of which are free milling and many containing high grade refractory ore showing gold, copper, lead, and zinc. On the most important claim developed, the Copper King, more than one thousand feet of underground work has been done and a three stamp mill has been operating for some time. This mill is the property of W. Hanson and is equipped with a simple stamping outfit. Six dollars is realized a ton as the ore goes over the plates and, in addition to this, rich concentrates have accumulated.

This district contains about 20 developed or partially developed claims, all of which have been bonded to a company in the United States.

While, as has been said before, the main bodies of ore running through the group seem largely of a refractory nature, one ledge is a marked exception. This ledge is found in the Philip claim and averages a width of about eight feet throughout the length of the claim. The ore is composed of calcite and manganese and averages about $8 a ton, free-milling

Another ledge in the group, known as the mother lode, is over 30 feet in width and assays over $30 a ton. Many other smaller ledges of refractory ore are reported to run over $100 a ton.

Three more claims, covering a water-power site, have been located and some sixty horse-power of water will be available throughout the entire year.

The claims are now owned by Doctor J. R. McDill, Major Thomas L. Hartigan, Captain Charles H. Marple, and the estate of John Hartwell, and it is the intention, on the return of Dr. McDill from America, to install a complete plant and develop and work the mines to their full capacity

THE CAMOTE CLAIM

This claim, which is situated farther down the Antimok creek from the Consolidated property, is controlled by Nels Peterson, one of the oldest mining men in the Benguet mining region. C. Clyde is also interested in this property. Much development work has been done and a three-stamp mill has been in successful operation for some time with the result that a goodly sized brick of gold is sent out from this property every month. There is plenty of pay ore on the dump and the property at its present stage of development warrants an increased milling plant besides a cyanide outfit. At the present time the improvements are limited and do not include cyanide equipment and as a result much of the gold product is lost. Even with the limited outfit a white foreman and a few natives take out from $25 to $40 a day while the balance goes down the creek.



OPERATING THE MEAD ON THE BUED RIVER, BENGUET.

THE SUNSET GROUP

Lying above the Benguet Consolidated Mining Co.'s claims in the Antimok district are two valuable mines that promise returns equal to that of the more developed properties. These claims are known as the Sunset and Murphy and are owned by Charles M. Jenkins, Judge W. A. Kincaid and W. McElroy. Mr. McElroy was the original locator and while a minimun amount of development work has been done seven leads that give promise of a large volume of ore have been discovered. The several claims are marked by the workings of Igorots and much gold is reported to have been taken out by the native miners by their crude methods. It is the purpose of the present owners to expend a large sum for development the present season.

THE PENARANDA PLACER FIELDS

About 15 miles north-east of San Isidro, the capital of Nueva Ecija, and 5 miles east of the pueblo of Peñaranda lie the placer fields of the province of Nueva Ecija. Little development work has been done outside the ditching and sluicing by Fred L. Dorr, the pioneer prospector and miner of that region. In all Mr. Dorr has eight



THE FIRST GOLD OBTAINED BY CYANIDE PROCESS IN THE PHILIPPINES.

THE EASTERN MINING CO., MASBATE

In the Aroroy mining district, Masbate, where, outside Benguet, there has probably not been a greater amount of development done, lies a group of seventeen lode claims the property of the Eastern Mining Co., one of the pioneer corporations interested in the development of the mineral resources of the Philippine Islands. In all the area of these claims is about 340 acres and all, with the exception of five, are in the process of patenting. The location of this group is about four miles from the pueblo of Aroroy on the north-east coast of the island, and on the Guinobatan river. To better describe the mineral region it might be said to be confined to the south east of Aroroy and along the Lanan and Guinobatan rivers that empty into Porto Barrera. At least all present operations are confined to this locality.

Masbate is about 250 miles south of Manila and may be reached by steamer in about 30 hours from the Philippine capital.

The trail from the town of Aroroy to the Eastern property is about five miles, the first three miles being over a rather undesirable road. The company is building a substantial roadway along the river to the property, a distance of two miles, and, when it is completed, will have the effect of greatly improving transportation facilities and thus reduce freight rates which are now exorbitant. It costs from four to ten pesos a ton from Manila to Aroroy and six pesos a ton for toting to the Eastern property at the present time. The following is a list of the claims and their respective areas:

Name.	*Area.*
King	22.9568 acres.
Have Got (fraction)	21.5889 "
Nebraska Star	22.9568 "
Holy Moses	22.5310 "
Elise	22.5968 "
Sweetheart	22.5968 "
Mabel (fraction)	22.9005 "
Nancy (fraction)	22.8163 "
Mountain Maid	22.9568 "
Can Do (fraction)	6.0067 "
Never Sweat (fraction)	10.9381 "
Doris (fraction)	12.7339 "
El Dinero	22.5 Appx."
El Oro	22.5 " "
Alice	22.5 " "
Jessie (fraction)	20.0 " "
Katherine (fraction)	2.5 " "

The holders of the first twelve claims named above organized in 1901, and incorporated in 1903, the Eastern Mining Co., of which the Officers are at present as follows:

President - - - - - - - - - A. Heise.
Vice-Presdt. and Sec. - - - Geo. Morgan
Treasurer - - - - - - - - - Gay H. Parsons.

Directors. - - - - - A. Heise.
C. H. Parsons.
T. D. Aitken
W. J. Shaw.
B. H. Berkengotter.
T. M. Devilbliss.

Some work has been done on all these claims to develop the volume of ore and many leads have been exposed, but particular reference is made to Have Got and Nebraska Star claims. In fact the efforts of the company have been directed to the development of these two properties and on the Have Got claim a five-stamp mill has been installed to handle the ore from that claim.

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claims prospected more or less. He has provided a ditch from a branch of the Rio Chica to the claims, a distance of one mile. Every rainy season for the last two years some gold has been taken out, but unfortunately the sluicing outfit could not survive the yearly flood. Mr. Dorr expresses himself satisfied with the prospects for placer mining and is preparing to make extensive improvements of a more permanent nature. No definite data could be secured as to the actual amount of gold taken out from these workings.

Besides the Dorr group, Messrs. Sprungli & Co. have four claims in this region but no perceptible development has been done on their property.

The veins all strike approximately north-west and south-east and the dip is south-west.

On the Have Got and the Nebraska Star there exists a large quantity of ore that can be milled immediately while on the others there has not been sufficient development work done to definitely pass on the value or the quantity of the ore. On the two claims referred to there has been a large amount of development work completed, and at the present time a force is daily engaged uncovering the hidden wealth. On the Have Got an open cut 177×125×20 feet in all has been worked to supply a five-stamp Union Iron Works' mill that has been installed on this property. Clear across the face on the south-east side of the shaft mouth in this open cut, the quartz is solid for over 52 feet. In addition to this there are two very clearly defined veins which appear to have been the scene of old workings and averaging 8 feet in width each. One of these veins assays $12 a ton. There have also been developed extensive old workings for many feet up the hill including some shafts 30 feet deep, tunnels and pit that indicate greater prospect for the uncovering of veins not yet touched.

A shaft has been sunk in the hanging wall of the east vein in the open cut of the Have Got. This shaft is 6×6 feet and is sunk vertically to a depth of 30 feet. From the bottom of this vertical shaft an inclined winze has been sunk on this six-foot vein, in all, to a depth of 160 feet and a crosscut 215 feet to the surface on this level completes one of the most important features of the development of this claim. The vein, as drifted on at this level for about 70 feet, assayed $8.27 a ton. The main cross-cut has since caved owing to poor timbering.

The further development of the company's property has been impeded by the fact that the mill is entirely unsuited for the work. Besides there are serious errors of construction so that it has run only a small portion of the time since its installation. The following report from the official records of the government assay office shows the amount and quality of the bullion shipped from this property:

Oz.	*Fineness.*	*Value.*
16	.733	$240.
11	.687	150.
29	.710	425.
10	.684	155.
1	.....	15.
40	.703	588.
2	.....	30.
22	.763	350.
54	.858	965.
18	.....	300.
83	.772	1320.
45	.660	620.



APPROACH TO "HAVE GOT" TUNNEL AND CHUTE ON EASTERN MINING CO.'S PROPERTY, MASBATE.

A total of 331 oz., with a value of $5158.00. From the mill return book, the following data are taken:

"Sept. 19 to Oct. 11, inclusive. A total of 31 oz. 17 dwts. of amalgam were taken from the plates: at the clean up Oct. 13, 40 oz. 12 dwts. were obtained, a total of 72 oz. 9 dwts., which yielded 15 oz. 18 dwts. of retort metal. The clean up of Sept. 16 gave 25 oz. 11 dwts. of retort metal, and the two added were shipped to Manila, yielding 40 oz. of gold, .703 fine, valued at $588.00.

"From April 11 to May 3, inclusive, 114 oz. 6 dwts. were taken from the plates, and 30 oz. 8 dwts. at the clean up, a total of 144 oz. 14 dwts. This, retorted, gave 29 oz. gold (34% of the weight of the amalgam), of a fineness of .710 valued at $425.00.

"From May 7 to May 26, inclusive
Plate 66 oz. 8 dwts.
Clean up 27 oz.
Total 95 oz. 8 dwts. amalgam,
with other amalgam, amounting in all to 241 oz.; dwts., it was retorted and gave 28 oz. 14 dwts. of gold.

"Run of May 31 to June 26:
Plate 116 oz. 8 dwts.
Clean up 30
Total 146 oz. 10 dwts.

"This amount of amalgam yielded 56 oz. 16 dwt. of gold (or 38.9%); a shipment of 54 oz., .858 fine, value of $965.00. There is no means of estimating the amount of ore put thru except that, as the stamps are 800 lbs. only, and crushing through 60 mesh, and as the mill is extremely poor in design and construction, it could not have been the normal amount per stamp. Delays and stoppages on account of breakage were numerous, and finally cam shafts and bearing gave way putting the mill out of commission. From the percentage of gold in the amalgam, and the amounts obtained in these runs, it is clear that an excellent saving could be made with a well designed and well built mill. The boiler, engine, and various small parts are in good shape, and re-erection can be made at small cost. The iron frame of the old mill, with its antediluvian mortar should be abandoned and replaced by a timber frame and modern mortar box."

In the old dump from the old workings on the Have Got claim is a large amount of loose material that runs from $9 to $12 a ton. This ore is oxidized and can be handled at little cost. It is estimated that there is about 5,000 tons of this material available. It might be said that on the Holy Moses claim there is a similar dump, but no estimate of the amount it contains is available.

The newest and most important workings are to be found on the Nebraska Star. The outcrop can be traced from the open cut on the Have Got to the north-eastern end of the Nebraska Star where the work of development is still progressing. Several open cuts expose the vein along the north-west and south-east strike and a 40 foot shaft has been sunk on the foot wall. A crosscut tunnel has been driven at a depth of 112 feet below, cutting all the lodes. The direction of this tunnel is south-west across the strike and its estimated length 250 feet. The following, taken from a report of Mr. A. J. Eveland, mining engineer and general manager of the company, and which has been authenticated gives an idea of the development work on this property:

"At this date, four veins have been cut and drifts driven on each both ways from this cross cut. Vein number 1 has been drifted on to the south-east for 180 feet and to the north-west for 110 feet. It has clean cut walls, strikes south 35° east, and dips 700 south-west.

"On the north drift, at a distance of forty feet from the cross cut, a fault cut off the vein, but work was carried on, and the vein picked up 12 feet to the north-east, wider and carrying more free gold than before. Vein No. 1 averages 3 ft: 4½ in. in width, south-east of the fault and about 6 feet in width to the north-west. Sampling on Vein No. 1, Star Tunnel level, gave an average value of $5.21 (U. S. Currency) over an average width of 3 ft. 6 in. The values are very evenly distributed and on the south-west drift of this vein a slightly higher grade ore shoot comes in which will yield an average of $8.50. The widening out of this vein, the north-west of the fault, is noteworthy, and heavy high grade concentrates are appearing in larger quantity as development progresses.

"Vein No. 2, parallel to No. 1 at a distance of 44 feet to the south-west, has been developed for 50 feet on the south and 90 feet on the north sides of the main cross cut. It has a steeper dip (to the southwest) but the same strike as No. 1. It is heavily oxidized and the sampling gave an average of $12.14 to the ton, over a width of 4 feet 3 in. In common with No. 1 it has beautifully regular walls and even distribution of values.

"Vein No. 3 has been drifted on for 35 feet on the north side and for 20 feet to the south of the cross cut. Its strike is that of No. 1 and No. 2 and in width it averages 4 feet 6 inches. It will average about the same in value as No.1 and No. 2.

"No. 4 vein parallels the first three again at a distance of ten feet to the southwest. Assays of $18.29 per ton were obtained from the development of 25 feet on the southeast side of the cross cut.

"A shaft has been sunk on No. 1 vein to the cross cut, meeting it over the junction of the cross cut and the drifts on the vein. Sampling of it gave assays ranging from $14.50 on the surface ores, to $6.00 at the No. 1 vein level, indicating the even tenor of that vein. The vein in the shaft averages about 4 feet in width. This shaft gives excellent air connection for the lower workings and proves up the No. 1 vein finely, in connection with the underground and surface work.

"Only a small amount of work has been done at a lower depth. A second level has been started on No. 1 vein, the opening being made from a gully a few hundred yards to the south-east.

"The character of the ore in these veins and workings is uniform, a hard vitreous quartz, showing banded structure, well oxidized at the lower levels, and carrying concentrates of higher grades in the form of iron pyrite.

"There is hardly a way of estimating the quantity of ore available in the "Have Got" workings, except that the open cut could supply a large amount immediately. The old dump on the "Have Got" contains under foot at least 5,000 tons, ready for immediate treatment, valued at $10.00 per ton.

"Vein No. 1 of the Star has been proved up on three sides on the north side and on four sides on the south side of the cross cut, and it is estimated that there is a body of ore here 300 feet long by 3.38 feet wide by 125 feet depth, or about 130,000 cubic feet. Tests have given the number of cubic feet to a ton of this ore as 13, and this gives a result of about 10,000 tons of ore, valued at $5.21 per ton in the vein No. 1, "which may reasonably be supposed to exist," from the careful sampling and development.

"Veins Nos. 2, 3 and 4 cannot yet be figured on as they have not been developed. It will be only a few months' work to prove up these ore bodies by upraises and drifts, and development of ore will proceed more rapidly now that the first levels and crosscuts are completed. It is particularly difficult to place any value on a property in such a state of development as this, but the total of $100,000.00 exposed ready for immediate milling should be enough to warrant the construction of development work and the installation of a mill.

"From tests made on these ores, it is found that outside of the old dumps, and the surface ores, only about 25% of the value will be free milling. There is present a variable percentage of concentrates, almost entirely iron and it will be necessary to concentrate and cyanide. The ores show no indication of becoming more basic, and probably there will be two hundred feet more in depth of partially free milling ores; no elements detrimental to cyaniding have been observed in these veins, and tests show that an extraction of over 90% may be made.

"Although but few figures are available for the cost of operation of mines, mills and of ore treatment, under the conditions in the Philippines, it can be safely said that $5.00 ore can be handled on this property at a profit and anything above that will be clear gain. There are no difficulties locally in the way of economic handling of material, in fact conditions on the ground may be considered almost ideal for operation on a large scale, when extent and value are proven. Labor, water, fuel, timber, character of ore, "lay" of the lodes, etc., are all most encouraging in aspect and from surface development over a large area, it would appear that there is to be expected large, regular ore bodies. Treatment will be comparatively simple, and transportation of supplies can be done cheaply."



E. M. BARTON, PRESIDENT OF THE MOUNT COGRAN MINING CO., MASBATE.

"The outcrops on the Elise claim are quartz which pans high (about $15.00) in free gold. Old workings occur to a considerable extent, and it is presumed from good evidence that these were operated by Chinese over a century ago. The other cuts made recently have not progressed sufficiently to more than to assure the presence of a vein, but the line of old dumps and pits continues to the Southeast some 4,000 feet; on some of them at least one vein four feet in width is exposed, dipping 65° Southwest, and with a strike of north 45° west, approximately.

"The 'Jessie and Alice' claims have been recently located, and no work of any importance has been done. A vein of unknown width and value outcrops at the Southeast corner of the 'Alice.'

"On the 'Sweetheart,' an open cut again shows vein material, strike north 30° west, dip, with a width of six inches, which is probably a stringer paralleling a vein not yet exposed, striking North 35° West, and with a dip of 90°. Not enough work has been done here as yet to warrant sampling.

"The 'Nancy' and 'Mabel' claims show Northwest-Southeast outcrops over a considerable distance, and two tunnels, one on each claim, have been started to test the veins. On the 'Mabel' the foot wall assayed $1.65 over a distance of 60 feet, the vein being only broken into at the time of this report, and consequently the width and value of it are not known. The outcrops, however, of the 'Mabel,' are some of the heaviest in the group, and certainly measure over ten feet. Where one of these veins is believed to come thru on the 'Gold Bug' group, the old workings indicate a width of about thirty feet, and the outcrops are the richest in free gold in the district.

"The 'Never Sweat' on the north side of the Guinobatan river has a high grade vein of unknown width, shown in a 35 foot shaft, from which samples of from $50 to $125 have been reported. An 80 foot tunnel to cross cut this lode has not as yet reached it. This claim and the 'Mountain Maid' show apparently the same veins, of about four feet in width, of which no more may be said other than that it pans free gold, and that one assay gave a value of $6.20. Several tunnels and pits have more or less indicated the course of the vein, which is about North 45° West.

"The 'Holy Moses' shows one vein in a thirty foot tunnel and on the 'Catherine' fraction, another outcrop appears.

"On the 'King' a five foot cut shows quartz carrying free gold and northwest-southeast stringers cross the 'King' creek,—southeast of this location. On the 'El Dinero,' and 'El Oro,' there are as yet no workings.

"The 'Doris' has two noteworthy outcrops, a large vein (8 feet) striking northwest and carrying considerable copper sulphides (2.22% copper, $22.28 gold). Southeast of this is a shaft 15 feet deep, sunk on a 6 foot or wider vein, striking North 45° West.

"On none of the above claims is enough work done as yet other than to show that numerous veins exist, which show more or less free gold values. The ground has been secured, but most of the active development work has been confined to the 'Have Got' and 'Nebraska Star' claims."

EASTERN GOLD BUG MINING CO.

The newest figure in the Philippine field of active mining is the Eastern Gold Bug Mining Company, which has just commenced the operation of a ten-stamp mill at Aroroy, Masbate. The mill was started but a few days ago for a trial run, but seems to be a "payer" from the outset, judging from a beautiful bar of gold which came in on the last trip of the inter-island steamer "Nuestra Sra. del Carmen."

The property on which this mill is set up consists of a group of mining claims located by F. W. Beasley and William Edelmaier, two of the pioneers of the Masbate mining district, who have been holding down their locations for several years past.

The person responsible for finding the capital to open up these promising mines is W. H. Dodds, an attorney and capitalist of Pittsburg, Pa. Something over a year ago Mr. Dodds came to the Philippines as the representative of certain Pittsburg investors in order to investigate the management of a mining company which was operating in Masbate. Notwithstanding the fact that the affairs of the company under investigation were found in the worst possible shape, the mineral resources of the district made such an impression on the visiting attorney that before his departure after a few days spent on the spot he became interested in the "Gold Bug" group of Beasley and Edelmaier.

As a result of the efforts of Mr. Dodds a Risdon ten-stamp mill, with full equipment and a cyanide plant, arrived in Manila about the first of March in charge of Mr. M. P. Boag, an expert mill man sent out by the Risdon company. The outfit was at once forwarded to Aroroy and the work of setting up the mill has been pushed to completion in a little over two months' time.

The mill has ten stamps, each weighing 1000 pounds, and has a capacity of from 50 to 60 tons of ore daily. The first run, which began on May 20, was for a test only and lasted but a few days, with most gratifying results, however. This first run consisted of old dumps which have been lying on the ground perhaps for centuries. All of this old ore has now been cleaned up and actual work is beginning on the mine proper.

According to the opinion of expert mining men the "Gold Bug" makes a wonderful showing of a big body of ore. The rock is decomposed porphyry and the best values are carried in stringers of quartz.

A great deal of ancient development work is to be seen in this district and from the "signs," as the mining man reads them, this work must have been done centuries ago by Chinese miners. That these old time seekers for gold were Chinamen is inferred from the Chinese characters cut in the rocks, while the period when the work was carried on has been variously estimated at from 300 to 500 years ago, judging from the size of the trees which are now standing on the ground worked over.

At some former period there was also used in crushing the ore taken out the primitive mill known as the "arrastre," which by many is believed to have been introduced into the Philippine Islands from Mexico. That the arrastre has been in use in the district is evidenced by the occurrence of numerous rocks hollowed out for the grinding process.

At present the camp in charge of the superintendent, M. P. Boag, has a force of five Americans and twenty-five natives at work. The mill is being operated without cessation, the day being divided up into three eight-hour shifts.

THE COLORADO MINING CO.'S CLAIMS.

Another group of mines in Masbate that promises rich returns in the near future is under the control of the Colorado Mining Co. This company has secured by purchase the Buena Vista, the Buena Suerte, and the Grand View, and has secured the option on four other claims that does not expire until ninety days after the issue of the patents. These properties are located on the Bagadilla Mountain about three and one-half miles from the town of Aroroy, Masbate, and on the Guinabatan river.



COLONEL H. B. MCCOY OF MANILA, PRESIDENT OF THE COLORADO MINING CO. OF MASBATE.

The following is a description of the three claims owned by the company:

Buena Vista—The work of developing this claim has been prosecuted for a period of eighteen months. The main lode runs in a northeasterly direction and has been uncovered in 100 foot intervals for the full length of the claim, a distance of about 300 meters. At the point of discovery, 275 meters from the south end of the claim, the vein was uncovered and showed a width of ten feet, and at the discovery shaft the ore assayed $27.90 U. S. currency a ton. A tunnel was opened within 120 feet of the north end of the lode and near the top of Mount Bagadilla, where the vein showed nine and one-half feet in width and the ore at this point assayed from a grab sample $15.71 a ton. This tunnel was run in for a distance of 70 feet for the full width of the vein and fully timbered. The ore was piled at the mouth of the tunnel to the amount of approximately 700 tons. A grab sample of the ore from this ore pile taken in January, 1906, showed $16.12 and on February 13, with 300 tons at the mouth of the tunnel a grab sample assayed $20.47. Forty feet in from the mouth of the tunnel, where the vein measured eleven feet in width, a fair sample assayed $31.01. One thousand pounds of ore were taken from this vein, one-half from the mouth of the tunnel and one-half at a depth of 40 feet, and shipped to Luckhardt & Co. of San Francisco, who reported assays ranging from $19.64 to $21.70 a ton. These samples were tested by mill test and showed a valuation of $20.00 a ton, of which about 25% could be recovered by the amalgamation process and 70% per cent. additional by the cyanide process. Messrs. Luckhardt & Co. recommended cyanide treatment of the ores. Since January the vein has been cut every hundred feet from one end of the claim to the other, showing the same character of ore and approximately the same width of vein.

The following is an excerpt from the report of Messrs. Luckhardt & Co. upon this ore, its character and treatment:

"On the two lots to be tested, preliminary mill tests were made in order to ascertain their respective characters. These tests showed them to be identical and therefore a mixture was made of the two which mixture assayed about one ounce gold and which was used

for subsequent tests. The mill tests showed that a little over 20% of the gold value could be recovered by amalgamation; that the ore did not contain any concentrates (a very small amount of heavy sands could be panned out, which, however, did not contain any value). These tests were made on 20 and 40 mesh material and showed that 30 mesh would be preferable.

"A large mill test was made by running one-third of a ton of the mixture through a three stamp mill. The drop of the stamp was three inches, discharge, four inches; 90 drops a minute and thirty mesh steel wire screen. Quicksilver was fed into the mortar but the mortar had no inside plates. The pulp, after leaving the mortar, flowed over silver-plated amal-



CAPTAIN CHARLES H. SLEEPER, OF MANILA, ONE OF THE DIRECTORS OF THE COLORADO MINING CO.

gamated copper plates. The result of this mill run closely resembled that of the preliminary tests.

"Amount of gold recovered by amalgamation was:

From inside amalgamation_ ..065 oz. fine
From outside plates.....015 oz. fine
Total.....08 oz. fine gold.

which is 81.2% from inside amalgamation and 18.8% from outside amalgamation.

"As one-third of a ton contains .33 oz. of gold the percentage recovered by amalgamation is:

.08 oz. of .33 oz. is 24.2%.

"A part of the tailings were hydraulicly classified, resulting in about:

58% sands, assaying..... .56 oz. gold.
42% slimes assaying..... 1.02 oz gold.

"The value of the tailings in this:

In sands..... .58 x .56..... .32 oz.
In slimes..... .42 x 1.02..... .43 oz.
Total tailings.....75 oz. gold.

"Several cyanide tests were made as follows:

"On the original ore crushed to 20, 40 and 100 mesh, on the tailings as made and recrushed to 100 mesh, on the slimes (part of the tailings), on the sands(part of the tailings) as made and recrushed to 100 mesh, with different strengths of solutions and different times of contact.

"Sizing tests were also made on the 10 and 20 mesh material to discover how the values were distributed and to see if fine crushing would probably be necessary. The exact figures of all these tests cannot be recalled but the conclusions reached were as follows:

"A considerable part of the values are contained in coarse material (as shown by the sizing tests), which would indicate the probability of fine crushing.

"The cyanide tests showed that the ore is readily amenable to cyaniding but requires fine crushing for a high extraction. The best strength of cyanide solution should be about .3%. The consumption of cyanide per ton of ore is about 3 pounds. The time of contact required for leaching the sands and the original ore is from four to six days. A nearly complete extraction can be obtained by agitating the 100 mesh original ore, the tailings recrushed to 100 mesh, and the slimes with a .3% cyanide solution in about three hours. The 10 and 20 mesh material contained so much fines that leaching was retarded too much.

"The ore does not contain any free acid but shows only latent acidity, which required for neutralization about 3½ lb. lime per ton.

"Though the exact figures of all these cyanide tests are not available, the figures of the extraction percentages of the best modes of treatment are:

"(a) About 96% extraction can be obtained by crushing in stamp mill with 20 or 30 mesh, amalgamation, regrinding tailings to 100 mesh and agitation with cyanide solution.

"Particulars of this treatment:

"Mortar to be narrow and designed more with a view to crushing capacity than to amalgamation. Quicksilver is to be fed into the mortar but no inside plates. Stamps 1000 lb., drop 8 in., 95 drops a minute, 6 in. discharge, 25 mesh wire screen. Pulp to flow over silver-plated amalgamated copper plates, width of mortar, and at least 10 feet line. Incline of apron plates to be regulated by hand-wheel.

"Tailings are reground to at least 80 mesh by a tube mill or modern Chilean mill. All the tailings are then treated by agitation (3 hours) with a .3% cyanide solution. The filtering of the cyanide solution to be accomplished by a Butters-Cassel-Moore slime-filter or other slime filter of proved efficiency. The final tailings of this process are about .04 oz. of gold, which means a total extraction of 96%.

"(b) About 94.5% extraction can be obtained by:

"Crushing and amalgamating as under (a), separating the slimes from sands by hydraulic classifiers, then leaching the sands with cyanide solution—time of contact to be 6 days—and agitating slimes with cyanide solution and filtering as under (a).

"(c) About 93.5% extraction can be obtained by:

"Grinding the ore to 100 mesh, which could be done by a tube mill or Chilean mill, after the ore is broken by crushers, then agitating about three hours with .3% cyanide solution and filtering as before described.

"The precipitation of the values from the cyanide solution can in all cases be accomplished by zinc shavings.

"Reviewing the three proposed processes, (a) and (b) are to be preferred to (c), as any coarse gold which this class of ore is liable to obtain would be recovered by it and practically lost with (c). The question whether the regrinding of the tailings (which is the difference between (a) and (b) will pay, will largely depend on the extra cost of treatment, but it is our opinion that regrinding would be inadvisable. It would simplify the plant in this way: that one uniform treatment only would be required for the tailings and it has the benefit of extracting the value in a few hours, as compared with six days for leaching the sands.

"In conclusion we must say that your ore is very valuable. The cost of treatment depends largely on local conditions and the size of the plant, but it is not liable to be over five dollars a ton, and probably much less. The grade of your ore can, therefore, be much lower and still leave sufficient margin for profit.

"Development of your property should certainly be gone on with and when sufficient payable ore is opened up, it warrants the erection of a first class plant.

"Note.—The ore is a honeycombed quartz with an admixture of talc: is completely oxidized and in breaking up in a crusher produces rather more than the average amount of fines. As received by us it was rather wet."

There has been work done on this claim to the extent of ₱10,000.

THE COGRAN MINING CO.

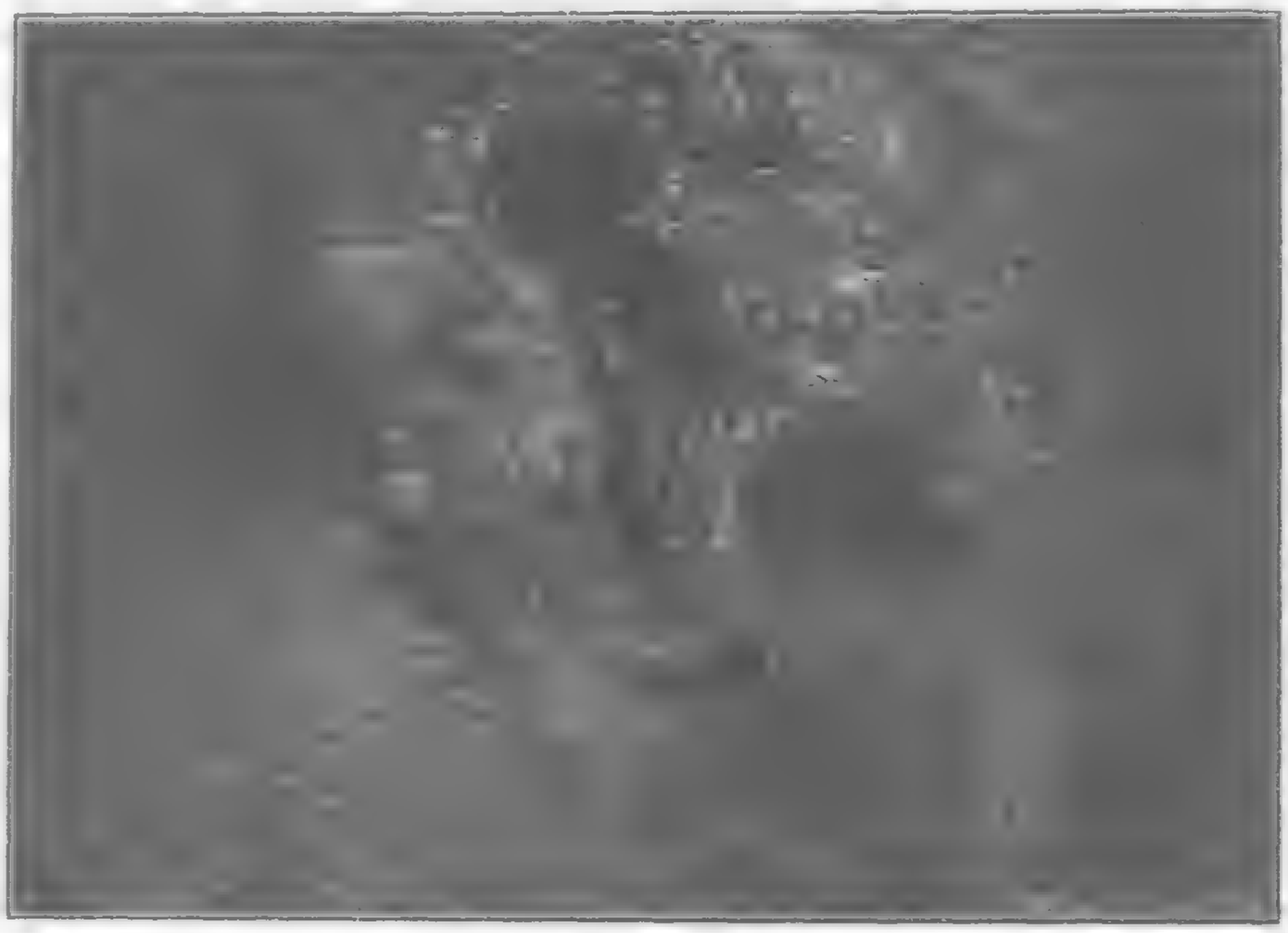
Among the companies interested in the development of the mineral wealth of Masbate is the Cogran Mining Co. This company continued its development work until about a year ago when it was decided to reorganize. Previous to this time, however, the reports made were very satisfactory and this article refers particularly to that period. The company has now reorganized and proposes to carry on the work.

The Cogran group is situated on the Lanang river about four miles above tide water on the island of Masbate and the properties may be reached from the coast by a road wagon.

The Cogran mineral claim is the first on the north-west end of the group. The main ledge on this claim is twenty feet wide, crops in several places and pans free gold. The surface of the claim is covered by an alluvial deposit that also contains gold.

A shaft is down 25 feet on the foot wall in serpentine. The hanging wall is granite. The dip of the vein is S. 41 degrees and the strike is S. 62 E. The Cogran has been selected as the site for a mill for the group of that name.

The Queen of Sheba claim adjoins the Cogran on the S. E. Development work on this claim and consists of one open cut on the vein 115 feet long and 25 feet wide. It shows a breast of ore 20 feet wide and 40 feet high.



IGOROT MINES IN THE BOA MINING DISTRICT, BENGUET.

By the amalgamation and cyanide process 95% of the gold and silver values can be extracted.

A tunnel commencing at the breast has been run along the foot wall for a distance of 90 feet to the bottom of a shaft 60 feet deep from which point the vein has been cross cut and is shown to be 40 feet wide and carries gold in paying quantities.

At the breast an incline shaft is down 60 feet on the foot wall. It shows the vein in place and as wide as at the breast.

A shaft on the hanging wall 125 feet S. from the incline shaft at the breast is down 60 feet or 90 feet below the level of the tunnel. The bottom of this shaft is in ore that pans free gold, but from which no assays have been made.

On both the walls of the vein there is an incrustation that pans native copper, but the quartz in the vein does not contain copper.

At a point 350 feet S. E. from the beginning of the open cut a wall of quartz 30 feet high by 150 feet long is exposed, into which a cross cut tunnel has been driven to a depth of 15 feet with no sign of the foot wall. The dip of the vein at this point is S. 41° and the strike is S. 62 E.

On the foot wall side of the ledge, this claim is covered with an alluvial deposit 1,000 feet long by 500 feet wide and is 15 feet deep. This carries free gold to the value of $1.00 a ton. The alluvial deposit is caused by the erosion of the ledge. The hanging wall is granite and the foot wall serpentine.

The Big Medicine mineral claim adjoins the Queen of Sheba on the S. E. The ledge crops the full length of the claim and is the extension of the ledge that passes through the Cogran and the Queen of Sheba. The ledge has been cross-cut in three places on this claim, showing ore in place to a width of 30 feet that pans free gold.

On the foot wall side of the ledge on this claim is an alluvial deposit 1,000 feet long by 500 feet wide and 20 feet deep, containing gold to a value of $1.00 a ton. The ore on this claim is a red honey-comb quartz. The strike of the ledge is S. 62 E. and the dip is S. 41.

The King Solomon adjoins the Big Medicine on the S. E. It is located on the apex of Mount Cogran and has an elevation of 720 feet above the Cogran mineral claim.

The same vein extends through the King Solomon, Big Medicine, Queen of Sheba and Cogran. It crops in two places on the King Solomon. The vein has two cross-cuts on the claim where it shows a width of 30 feet and pans free gold. The strike is S. 62° E. and the dip is S.

THE PALANAS GROUP

The Palanas Group consists of the O. K., Palanas, Imperial, Rosebud, and Endman mineral claims.

It is an extension of the Cogran Group. The same ledge extending through both groups.

MR. MCCASKEY'S REPORT ON THE COGRAN GROUP

In the Luia region lies the Queen of Sheba vein of the Cogran Mining Co. of the claim of that name. This vein, about 30 feet wide on the claim, runs for 3000 feet in a direction N. 62 W. and can be traced, it is reported, for 15,000 feet to the south-east. It dips to the south-west 40 degrees, passing under Mount Cogran. The vein matter is in part shattered quartzose and basic material cemented by quartz crystals and in part of rather massive blue quartz. The blue quartz is reported richer in free gold than other portions of the vein and in the shattered material the cementing crystalline quartz apparently bears gold. The main vein is wet, and both walls are lined with heavy gouge and marked by slicken side. Overlying the Queen of Sheba vein is a coarsely granular igneous mass, *granite* (*f. n.*), which constitutes the greater portion of Mt. Cogran. It is composed of hornblende, quartz, and apparently plagioclase feldspars, suggesting a tonalite. To the northeast of the Queen of Sheba vein lies two others parallel with it and 25 and 15 feet wide, respectively, with similar gangue, and 1000 feet to the southwest is another vein not well defined.



STAMP MILL ON THE MT. COGRAN MINING CO.'S PROPERTY, MASBATE.

But little work had been done upon these three veins at the time of my visit in May (1906) and concerning them but little evidence was obtained. Further southeast, the most southwesterly vein of this group, and of the system so far as known, is reported to be 100 feet wide as exposed on a section of a rocky cliff. In addition to the Queen of Sheba claim of Mr Lander, upon which the greater part of the development work has been done, lie the "Cogran," "Big Medecine" and "King Solomon" claims on this lode, located respectively by Mr. Collett, Mr. W. W. Clark, and Mr. R. N. Clark. These claims located on the vein 1000 feet northeast of the main lode by Mr. R. N. Clark, Mr. George Lander and Mr. W. W. Clark, respectively, are the "Louise," "Captain John," and the "Niagara." On the vein approximately 1000 feet southwest of the "Queen of Sheba" lode, lie the "O. K." "Palinas," "Rosebud," "Imperial" and "End Man" claims of Mr. Hunter, Mr. Collett, Mr. W. W. Clark, Mr. R. N. Clark, and Mr. Lander, respectively, and it is on the boundary between the first two of these that a small tributary of the Napangan river flows across the vein, forming a waterfall of 30 feet and exposing a width of 100 feet of vein matter. In addition to those are the "Lena" claim of Mr. Heise and "Hoosier" of Mr. Moore, northeast of the "O. K." Northeast of the "End Man" lie "Eastern Star," "Hawkeye," "Empire," "Bavarian" and "El Oro "claims located respectively by Mr. Morse, Mr. Shortess, Mr. Sibbly, Mr. Bartlett, and Mr. Saul. On the "Eastern Star" the vein is apparently 20 to 25 feet wide. On the "Queen of Sheba" vein a tunnel 200 feet long has been driven along the rim with an upraise 100 feet from the face of the surface. This uprise has been enlarged at the top to form an open cut 30 feet deep and forty feet across, exposing the ore. An incline shaft also extends along the foot-wall for 60 feet from the level of the tunnel. The bottom of this shaft is in bluish quartz assaying $14.06 to the ton in gold. The tunnel extends along the foot-wall for 30 feet beyond the open pit where the vein is cross-cut by a drift of 45 feet long running obliquely across. Over this cross-cut a shaft has been sunk 25 feet, but has not yet reached the workings below. In addition to the above exploration work a circular vertical shaft has been sunk for 60 feet from a point 150 feet south of the cross-cut, and a number of short drifts, cross-cuts and strippings further expose the ore-body of the vein.

"As a result of the extensive workings on the Queen of Sheba claim a dump estimated to contain 2,500 to 3,000 tons of ore is now available for crushing. Samples of selected ore from this dump assayed $24.39, and a general sample returned $14.06 to the ton in gold.

"The Mount Cogran Mining Co. having opened up considerable ore and having a dump of sufficient value to pay for the plant have recently imported and erected a modern Union Iron Works 10-stamp mill with 1,000-lb. stamps, single discharge narrow mortars and two apron plates 4½ feet wide and 12 feet long. A track has been laid along a leveled way from the mouth of the tunnel and ore dump to the crushing house and the ore is carried along this by four patent steel dump cars with a capacity of ¾ tons each. The ore is crushed in a Union Blake crusher of 7×8 inches, passes through a grizzly 4×10 feet in size with two inches between the bars, falls into a fifty ton ore bin and is fed by two patent challenge feeders to the stamps. From the amalgamation tables the tailings are led by sluices and impounded for the present for future treatment by the cyanide process. The topography of the ground and the design of the plant have been so utilized that the material is handled at a minimum cost by gravity alone. Although a 40-ton cyanide plant will be eventually installed, the company will crush and amalgamate only at this time. Power is obtained from a 30 H. P. self-contained throttling engine of the single slide valve type with automatic cut-off. The steam is generated in a 40-H. P. horizontal tubular boiler with a heater and Cameron feed pump. Water is pumped from the Luia for steam purposes by a Worthington Duplex pump and the fuel used is native firewood furnished at $1.50 a cord. The consumption will probably average 3 to 4 cords a day giving a cost of not more than $6 in twenty-four hours. The 1000-lb. stamps drop 100 times per minute crushing the ore through a 40-mesh screen. The mill timbers are particularly noteworthy, being of hewn and squared sticks of the finest native hardwoods, molave, betis, red narra, guijo, acle, amuguis, and lauan. The engine, boiler and fly-wheel are on cement foundations resting on bed rock and the ground sills are morticed on molave piles driven to solid rock. Another noteworthy feature of this remarkable mill is that its heaviest parts were swung from a crane on the Lanang river where they were unloaded from cascos placed on a wagon of special design, hauled four miles to the mill-site over a road and bridges constructed for this purpose and swung into final position on timbers prepared to receive them without at any time resting on Masbate soil.

OFFICERS OF THE COMPANY.

The officers of the Coglan Mining Co. are well known business men of the islands. Capital has never been plentiful in the Philippines and for this reason mining men have had struggled along without outside assistance. At the last meeting of the stockholders the following officers were elected:

President, E. M. Barton: Vice-president, Zan F. Collett; Directors: Colonel Joseph N. Wolfson, L. B. Wilhelm, M. Martin, Zan F. Collett, and E. M. Barton.

FAR EASTERN ENGINEERING, CONSTRUCTION, COMMERCIAL AND FINANCIAL NEWS

ELECTRIC RAILWAY, LIGHT, POWER, ETC.

TOKIO ELECTRIC TRUST.—The amalgamation of the Yokohama Kyodo Eelectric Light Company and the Kanagawa Electric Light Company was completed on May 16.

HONGKONG ELECTRIC.—The Hongkong Electric Co., Ltd., have decided to pay a dividend of 10 per cent, write off 44,120 for depreciation and carry forward to next account, $2,951. It seems to have been a fairly satisfactory year.

KONGMOON TRAMWAY.—A Hongkong merchant, Mr. Yip Yin, of the firm of Wah Yik Company, has applied for permission to float a company with a capital of $1,300,000 to build an electric tramway at Kongmoon, in Sanwui district.

YOKOHAMA ELECTRIC EXTENSION.—The Yokohama Electric Railway Company has applied to the Kanagawa Prefectural Office for permission to extend the present terminus in front of the Kanagawa Station to Gotemmachi, via Shichikencho, Takisbitacho, and Ryoshimachi.

NIPPON AUTOMOBILE CO.—A consultation meeting of the shareholders of the Nippon Automobile Company which lately obtained official permission to run automobiles for passenger traffic in Tokyo, was held in the Y. M. C. A. at Kanda, Tokyo, recently, when a resolution was passedto reduce the Company's capital by 2,000,000 yen.

ELECTRIC TRAM SERVICE FOR NANKING.—A Nanking dispatch states that work upon an electric tramway between the Viceroy's yamen and Hsiakuan, where the steamers of the Yangtze service moor, a distance of about six miles or so, is to commence without delay. The contract for laying the line was given by Viceroy Tuan Fang last December to Taotai Wang Feng-hao.

NAGASAKI-MOJI TRAMWAY.—The authorities are now considering an application from the Nagasaki Electric Lighting Company for permission to construct an electric tramway from Nagasaki to Moji. The residents of the latter place have decided to present the land required for the scheme in their district, as they believe the construction of the tramway would materially benefit Moji.

CHANGE TO ELECTRIC POWER.—The Buso Central Railway Company, which recently obtained official charter to construct a railway from Sendagaya, Tayotamagori, Tokyo-fu to Odawara, Kanagawa prefecture, a distance of 53 miles, has decided to change the proposed steam motive power into electricity. The Company will apply to the authorities for permission to effect this alteration.

INDIAN ELECTRIC TRAMWAYS.—Consul General W. H. Michael reports as follows from Calcutta: The progress of the mining industry of Mysore State is shown by the fact that the government has issued an order under the Mysore Tramways Regulation Act of 1906 authorizing the construction by the Mysore Manganese Company (Limited) of a tramway (electric line of railway) from the Shimoga railway station to the manganese mines near Kumsi in the Shimoga district.

CHINESE TRAMWAY FOR SICAWEI.—A Nanking dispatch to the "Shenpao" states that a certain Taotai Wen Ho presented a petition the other day to Viceroy Tuan Fang to the effect that the former had obtained a mercantile capital of a million taels and offered to construct the proposed electric trams in Nanking. In reply the Viceroy stated that the Government having already decided to itself construct the Nanking electric trams, the money was not needed in that city but the petitioner could use the money obtained by him to construct a trolley line connecting Sicawei with other parts outside the foreign settlements.

SPRINKLERS ON SIAM TRAMWAYS.—The Siam Electricity Company will in the near future have in use for watering the roads over the whole of their tramway system a water-sprinkling-electric tramcar of the McGuire-Cummings type. The tank is a horizontal cylinder 5′ by 9′6″ mounted on an ordinary tram truck, and will have a capacity of 1,200 gallons. Connected with the tank will be a turbine pump with electric motor which is able to deliver 250 gallons a minute, 100 feet head, and for ordinary use this will throw a horizontal spreaded stream of water 50 feet to the side from the centre of track. This tank will also be of great use in case of fire. It will also be fitted with hose, and a one inch fire nozzle. By this means a stream of water can be thrown 80 feet. The pump can raise the water from 25 feet and fill the tank in five minutes."—*Journal of the Engineering Society of Siam.*

WIRELESS TELEPHONE.—A wireless telephone of the most simple nature has been invented by Mr. Tako Shojiro of No. 45, Gochome, Aoyamaminamicho, Tokyo. The inventor is a young man of 27 years of age. The new machine is now named after the inventor, the Tako wireless telephone. He claims, according to the *Tokyo Asahi*, that his system is far superior in every respect to others in the world, of which there are now two different kinds. Whereas the latter are defective for practical purposes, it is asserted that the Tako wireless telephone can be worked quite easily and perfectly between ships in motion and even across walls, which are effectual obstacles for its rivals. Moreover, the new contrivance is simple in construction and cheap in price. It is further stated that it can be connected with ordinary telephone apparatus and easily worked. In February this year the inventor applied to the Patents Bureau for a patent for his invention, but official sanction has apparently not yet been granted.

SIAM TRAMWAY EXTENSIONS.—"Important agreements were signed between His Majesty's Government and the Siam Electricity Co. Ltd., and the Menam Motor Boat Co. Lt.," says the *Bangkok Times*. In the case of the Electricity Co. the new agreement forms an addition to the agreement signed on the 9th November 1901, and provides for the construction of a line along Rajawongse-road, an extension of line from the terminus at Pakanam Railway bridge for 400 metres along the Hua Lampong-road, and the construction of a line on the Asadang-road (beginning near Messrs. John Sampson and Son's) and running to the river. The Menam Motor Boat Co. have secured the right to construct and operate a line from the northern mouth of the Paklat klong to and through the town of Paklat.

The Electricity Co. undertakes under penal clauses to provide fire engines and pumps and a staff ready to go anywhere over their system by night or day in case of fire, and further to provide five elevated water tanks with a capacity of 25 tons each for fire protection. In addition the Company undertakes to water the streets daily over which their system passes.

RAILWAYS AND RAILWAY SUPPLIES

HOKKAIDO RAILWAY CO.—The Hokkaido Railway Company held a general meeting in Tokyo on May 15th. During the last half year, the company sustained a loss of *yen* 86,607.29.

SHANSI RAILWAY.—The chief engineer of the Peking syndicate has reported to the Governor of Shansi that the railway from Pingtingchou to Tzechou in Shansi, which just been surveyed, will be completed in four years.

AMPO RAILWAY.—There appears to be a strong probability that the reconstruction of the Mukden-Antung line—known in Japan as the Ampo (Antung and Hotien) Railway—will be abandoned in favor of a road from Kirin to Antung.

KIRIN-CHANGCHUNG RAILWAY LOAN.—Peking wires that the sum of money the Chinese Government is going to borrow from the South Manchurian Co. for construction of the Kirin-Changchung railway is stated to be something like 4 million *yen*.

CHINESE RAILWAYS.—The Chinese department of posts and communications has decided that all railway concessions granted to mercantile syndicate shall last for 25 years only, and that after the expiration of 25 years the railways will become the property of the Government.

KAGOSHAMI RAILWAY EXTENSION.—The Yatsushiro-Toshimatsu section of the Kagoshima Railway will be opened to traffic in April or May next year, when Tokyo and Kagoshima will be connected, the only interruption being the Bakan straits. The journey will then be covered in about 40 hours.

ASAN RAILWAY CO.—Official charter was given under date of May 2 by the Japanese government to the Asan Railway Company to construct a line from Muyomachi in Tokushima prefecture to Takamatsu city in Kagawa prefecture, a distance of 42 miles 30 chains, with a capital of 2,000,000 yen.

BUSO CENTRAL RAILWAY.—Official charter was granted under date of May 6 to lay the Buso Central Railway from Sendagaymachi, Toyotamagori, Tokyo-fu to Odawara, Kanagama prefecture, a distance of 53 miles. The scheme is promoted by Mr. Amenomiya and 81 other persons with a capital of 2,500,000 yen.

PROPOSED KOREAN RAILWAY.—Messrs. K. Okura, T. Nagamori, and twenty other persons are promoting a railway company with a capital of 20,000,000 yen for the purpose of constructing a railway between Gensan and Chinnampo via Phyong-yang, a distance of 191 miles. The promoters have applied to the authorities for a subsidy of 6 per cent.

KWANSEI RAILWAY CO.—At the Kwansei Railway Co.'s general meeting at Yokkaichi, Mr. Kataoka, President of the Company, spoke on the conditions during the last half of 1906 and on the government's proposal with regard to the nationalization of the railway. The half-yearly net income was *yen* 803,544.95 and an interim dividend was declared at the rate of 6.32 per cent per annum.—*Japan Advertiser.*

THE HSINMINTUN-MOUKDEN RAILWAY.—Notwithstanding that all railway materials and tools that were prepared for the Hsinmintun-Moukden Railway are not included in the agreement for transferring the line to China, these have all been handed over to China under the orders of Mr. Goto, the president of the South Manchurian Railway Co., in order to improve the relations between Japan and China.

MANCHURIA RAILWAY EQUIPMENT.—Vice-Consul P. S. Heintzleman advises that the head office of the newly organized South Manchuria Railway Company will be located in Dalny (Tairen). The vice-president informed the vice-consul that the gauge is to be broadened to standard; double tracking is to be effected to Mukden 247 miles from Dalny, and possibly farther north; the whole roadbed is to be improved and the stations enlarged, which will require three years.

PHYONGYANG-GENSAN RAILWAY.—The construction of the Phyŏngyang-Gensan Railway, to be taken up by a private concern as recently decided upon, is not likely to be commenced at an early date. The railway constructed will connect Pyŏngyang with Gensan and Chinnampho. But the construction of the Phyŏngyang-Gensan section is an extremely difficult work. Unless a dividend of 6 per cent is guaranteed by the Government no private company will be able to take up the work.

YUNNAN RAILWAYS.—The French railway syndicate in Yunnan asked Viceroy Ting Changto of Yunnan and Kueichou some time ago to grant a concession to build a railway from Yunnan to Szechuan. The Viceroy, however, has not granted their demand.

The gentry of Yunnan now have appealed to the Viceroy to build the railway themselves. They state that the annual revenue of receipts in Yunnan amounts to Tls. 1,560,000 (Revenue, Tls. 600,000; Salt, Tls. 260,000; Rice; Tls. 700,000), which should be sufficient to build the railway.

THE PEKING-HANKOW RAILWAY.—The receipts of the Peking-Hankow railway for the year amounted to $7,200,000, of which $2,200,000 was devoted to general expenses, 2,300,000 to interest on the Belgian loan, $400,000 to interest to the board of finance, and $200,000 to a reserve fund, leaving a balance of $2,000,000. Of the latter sum one-fifth is apportioned to the Belgian syndicate, thus $1,600,000 remains as net profit. The receipts for the year show an increase of over twenty-five per cent on the previous year's working, and shareholders are looking forward eagerly to the longed-for redemption of the loan bonds.

TOYAMA-NAOYETSU RAILWAY.—The railway line between Toyama and Naoyetsu is now in course of construction. The Toyama-Uwotsu section (17 miles 65 chains) of the line is expected to be completed by the end of this year. Work on the Uwotsu-Ichifuri section (20 miles 33 chains) is to be started in the course of the present year, and the Nsoyetsu-Nagahama section (100 miles) has been just started, while the Nagahama-Ichifuri section (33 miles) is now in course of land survey. This latter section is the most difficult part of the work, there being such precipitous places as the well-known Gyashirazu and Koshirazu where a number of tunnels are to be built. It will be four years before this line is open to traffic.

KWANGCHENGTSE RAILWAY STATION.—A telegram from Kwangchengtse, Manchuria, reports that an extensive area of ground between the town of Changchung and the Russian railway station has been selected as the site for the construction of the Kwangchengtse railway station which will serve as a connecting link between the South Manchurian, the East China and the Kirin-Changchung railways.

The *Hochi* says that an understanding has already been effected between the South Manchurian Railway Company and the Chinese authorities, whereby it is agreed that as soon as the former raises a loan of yen 80,000,000 in Europe a part thereof shall be supplied to the Chinese authorities who are in need of funds for the construction of the Kirin-Changchung and other lines east of the Liao.

AN ARCTIC-URAL RAILWAY.—The Committee which examines all projects for new railways at St. Petersburg granted to M. von Knorre a concession to lay down a railway, which will be of great importance in developing the trade of Western Siberia. The projected railway will start at Sobam, which is on the left bank of the river Obi, nearly 20 miles southwards of Obdorsk, and its northern terminus will be on the Varandei Bay in the extreme N. W. corner of Siberia on the Arctic Ocean. A commercial harbor will be established on Varandei Bay, and a river-port on the river Obi. The total length of the line will be nearly 250 miles. The preliminary surveys have been made by the engineer who built the Baltic Railway, and he estimates the cost of laying down the Arctic-Ural Railway at £4,200,000. The line will be built by a private syndicate, in connection with which an export company will be founded on a large scale.

THE SOUTH MANCHURIAN RAILWAY COMPANY.—The total sum required to improve the various establishments of the South Manchurian Railway Company is estimated at about 27,880,000 yen. Of the above, about 10,510,000 yen is needed for the reconstruction of the Tairen station, for repairs to the Tairen, Changchung and other lines; for the construction of the Company's buildings, reconstruction of various stations along the lines, establishment of coal depots, and other works, while the remaining 17,370,000 yen is needed for the manufacture of 240 locomotives and over 3,000 passenger coaches and goods cars.

The work of repairing the entire length of the railway will be commenced by the middle of June. The Company has concluded a contract to purchase railway sleepers and other materials from the Mitsui Bussan Kaisha and the Okura Gumi, and has ordered 180 locomotives, 60 passenger coaches and 2,000 goods cars from America. Of the above seven locomotives and a number of passenger coaches are to be delivered to the Company by the end of June. It is reported that the transportation capacity of the South Manchurian railway will be doubled in a year.—*Japan Advertiser.*

PUBLIC AND PORT WORKS, WHARVES, ETC.

FORT WILLIAM MCKINLEY IMPROVEMENTS.—Work is now in progress on a ₱150,000 military prison at Fort McKinley, near Manila. The building will be constructed of reinforced concrete.

LOOCHOO ISLAND HARBOR IMPROVEMENTS.—Work for the improvement of Nawa harbour, Loochoo Island, will be commenced shortly. The cost, amounting to 700,000 *yen* was recently voted by the Diet.

BOMBAY HARBOR BRANCH.—The construction of the new harbor branch line which will serve the new Bombay docks is making good progress. A small section, indeed, is being worked for the bulk oil traffic.—*Railways.*

BAKAN STRAITS IMPROVEMENT.—The Nippon Government has decided to blow up sunken rocks at the entrance to the Bakan straits from the Sea of Japan and will ask the Diet for a sum of about 100,000 *yen* for the purpose.

CANTON BRIDGE CONSTRUCTION.—The iron bridge being erected at Yau Lan Man, near Canton, China, is to be 1,220 feet in length and 40 feet in breadth. The capital of the company is to be $1,000,000 in 100,000 shares of $10 each.

DOCKS FOR CHINESE POSTS.—The Peking government has decided to build docks in different provinces of the Empire. Big provinces will receive a subsidy of $800,000, medium-sized provinces $600,000, and small provinces $300,000.

CANTON WATER WORKS.—Work in the new bund goes on very slowly. From the steamer wharves to the Electric Power House the river front is strewn with water pipes, a foot or more in diameter, that are to be used in constructing the water works system for Canton.

ARTESIAN WELLS AT MILITARY POSTS IN THE PHILIPPINES.—The quartermaster's department has purchased an artesian well-boring plant having facilities for boring 3,000 feet. The first well will be sunk at Zamboanga and it is expected that the cost of boring together with standpipe will be about P20,000.

PEARL RIVER BRIDGE.—Preliminary borings for the foundations of the bridge to be erected across Pear. River just above Dutch Folly are now being made

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The completion of this structure will make the important island of Honam easily accessible from the city. Already property values on the island are rising.

MADRAS PORT WORKS.—The Madras Port Trust propose to incur expenditure on the following important works: Rs.1,24,000 for modern quick crane equipment for the harbor; Rs. 20,000 on the construction of a hydraulic power house; Rs. 3,800 for equipping the present 20-ton hand-crane with steam pier; expenditure for installing and using electric lights and fans in the offices of the trust.

TAIREN DOCK CONSTRUCTION.—The present dock at Tairen being capable of accommodating steamers of only about 2,500 tons, the South Manchurian Railway Company is contemplating the completion of the former Russian dock, which is partly constructed. It is reported that after the completion of this scheme, the dock will be capable of accommodating warships or steamers of about 20,000 tons.

STRAITS SETTLEMENTS: PUBLIC WORKS.—By an Ordinance dated 15th February last the authorities propose raising the sum of £7,861,450 for defraying the cost of the following works:—Singapore Harbor works, £1,264,000; Municipal waterworks, Singapore, £523,187; dock, Prai River, Lagoon, and graving dock and other construction work at Tanjong, Pagar, £2,162,600; Penang Pier extension, &c., £200,000; and waterworks &c., at Penang, £170,000.

TSINGTAU WATERWORKS.—Consul Wilbur T. Gracey makes the following report on the proposed extension of the waterworks at Tsingtau, China: The German Government of the Colonial territory of Kiaochow is calling for tenders for the erection of a new water system for the city of Tsintau, the estimates to cover (1) one pumping station; (2) a pipe line 12 kilometers (7½ miles) in length (connecting Litsun and Tsintau), with pipes measuring 400 mm. (15¾ inches); (3) piping for a high reservoir. Estimates are to be submitted before July 1, 1907, at 11 a. m. The plans, descriptions, etc., may be obtained by addressing the Governmental Construction Department (Kaiserlichen Bauverwaltung, Abteilung "Wasserwerk Litsun"), Department for the Litsun Waterworks. A charge of $5 is made. Closed offers should be addressed to the "Ne Wasserverorgungsanlage von Tsintau, China." The extension has been necessary owing to the fact that the present supply of water for the city is insufficient.

HUANGPU CONSERVANCY.—At a meeting of the Huangpu Conservancy Board held May 21, it was decided to accept, subject to certain conditions to be agreed upon subsequently, the Dutch tender for the dredging works at the Woosung Bar. Three tenders, it will be remembered, were put in, the lowest at Tls. 1,615,000 by a German firm, another at Tls 1,697,261 by a French firm and the highest at Tls. 2,187,798 by a Dutch syndicate. At the very outset there was reason to believe that the German tender was based on a misconception, and we may conclude that the Conservancy Board in arriving at its decision was of opinion that the work could not be done satisfactorily at the sum quoted by the lowest tenderer. The award to the highest tenderer, who happens to be of the same nationality as the consulting engineer, may give rise to comment in certain quarters, but there is every reason to believe that the board has gone thoroughly into the matter and has satisfied itself that the Dutch Syndicate was the only tenderer really capable of carrying out the work in an efficient manner.—*N. C. Daily News.*

MINING, MINERALS AND THE METAL TRADE

COAL AT PING HAI.—A coal mine has been discovered in the district of Ping Hai, and it is reported very rich and worth working. The native authorities intend to float a company to work the mine.

LUANCHOW COAL MINES.—Viceroy Yuan Shih-kai has proposed to raise a joint capital of Tls. 2,000,000 for the development of the Luanchow coal mine in that province, and has appointed Jao Chang-ling to prospect the mining area.

FUSHUN COAL MINE.—The South Manchurian Railway Company is making investigations as to the method of improving the colliery works at Fushun. It is believed that it will not be difficult to produce 1000 tons of coal a day.

C. E. AND M. CO. ENTERPRISE.—The new electrical installation at the Tongshan Mines of the China Engineering and Mining Co. is probably the largest, most complete, and most up-to-date in China. It has been in operation for several weeks.

IDZU GOLD AND SILVER MINES.—It is reported from Shidzouka that a gold and silver mine has been discovered in a forest near Dohimura, Idzu province. Mr. Furihata applied to the authorities on May 4 for permission to undertake experimental work.

CHINESE LEAD MINES.—A Chinese merchant, named Yeung Po Hing, of the Kwong Tat Company, has sent a petition to the Agricultural, Industrial and Commercial Department applying for permission to open a lead mine at Fu Yung mountain, near Lin Shan, with a capital of $50,000.—*S. C. M. Post.*

MONGOLIA GOLD MINES.—An agreement for working the gold mines in Kulun and Tukartunan, Mongolia, has been concluded between Russia and the Imperial Chinese Resident in Kulun, H. E. Yien-Tse. It is reported that the terms of the said agreement will be forwarded to Peking for approval.

COAL CAR SHORTAGE.—The Hokaido colliery owners are almost panic stricken on account of the incapacity of the Government railways to transport coal. At present there are 400,000 tons of coal awaiting transportation, and at least 3,800 tons are being daily produced. Even to transport the fresh output, 542 coal cars are required. The Government ran only about 300 cars, leaving 800 tons a day without the means of transportation. The collieries will therefore be compelled to greatly reduce the output and dismiss large numbers of miners.—*Japan Mail.*

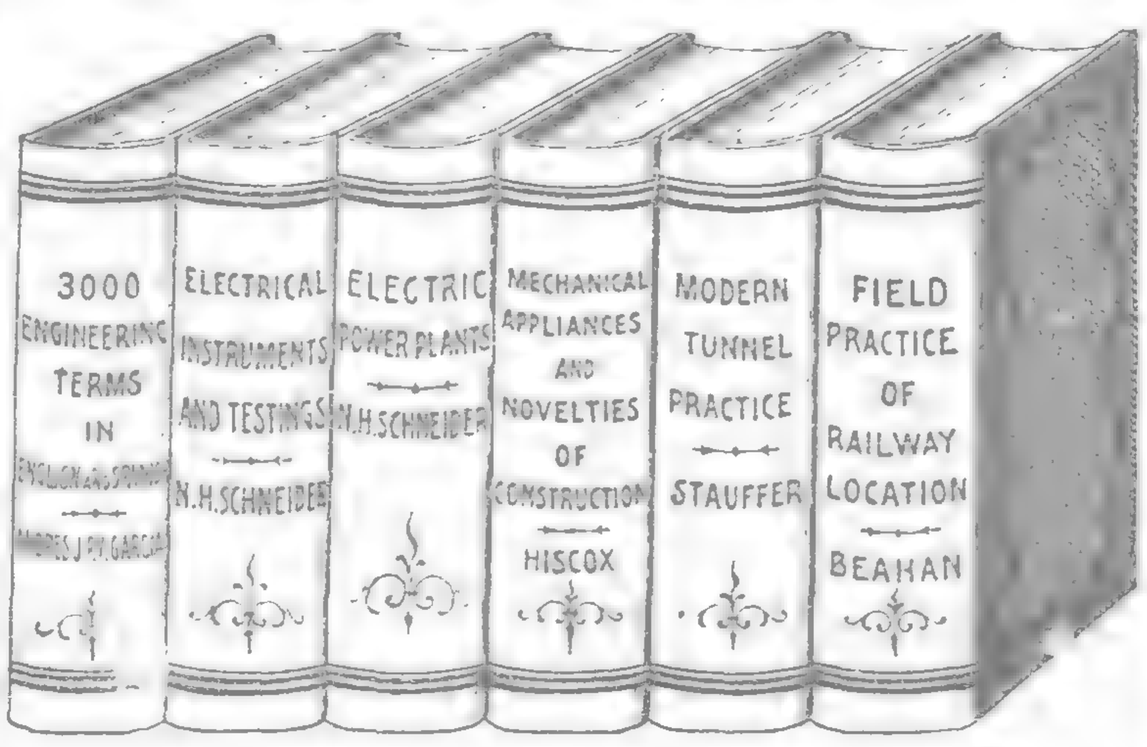
FINANCIAL AND MISCELLANEOUS

SHANGHAI INTERNATIONAL EXPOSITION.—It is proposed to hold an international exhibition of commerce at Shanghai about the end of 1908. The China Association are the promoters.

JAPANESE RUBBER MANUFACTURING CO.—A scheme is being promoted at Osaka jointly by a number of Japanese and foreigners to establish a rubber manufacturing company with 2,000,000 yen capital. The ground for workshops has already been purchased at Sagisu-mura, Nishinarigori, Osaka-fu. The greater part of the capital will be invested by foreigners.

JAPANESE BANK AMALGAMATION.—The promoters of the Hokoku Bank (10,000,000 yen capital) being organized by K. Hamaguchi and other influential business men of Tokyo, have opened negotiations with the directors of the Saiyen Bank (1,000,000 yen capital), the Hamamatsu Bank (500,000 yen capital) and the Hamamatsu Shinyo Bank (500,000 yen capital) at Hamamatsu in Shizouka prefecture, for amalgamation. The three banks held a meeting of Directors on May 12 when it was virtually decided to amalgamate.

AMERICAN EXPORTS TO THE ORIENT.—According to a statement issued by the Bureau of Statistics the exports from the United States to the Orient during the month of February showed an improvement over the corresponding month of 1906. The exports to Japan showed a decrease of $21,000,000 for the calendar year 1906, as compared with 1905, and the exports to China a decline of $28,500,000. During February the exports to Japan showed a gain of nearly $500,000 over those of February, 1906, while the reduction of exports to China was more than $1,000,000. The exports to British India decreased from $557,644 in February, 1905, to $525,864 for the same month this year, but for the eight months ending with February they increased from $4,057,041 to $4,886,755.



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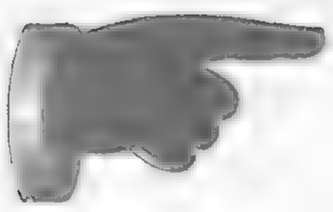
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PUBLISHED BY THE BUREAU OF SCIENCE OF THE PHILIPPINE ISLANDS

A Journal devoted to the scientific work done in the Philippine Islands by members of the Staff of the Bureau of Science, and by other scientific workers.

Beginning with Volume II, January, 1907, the Journal is divided into Three Sections:—

Section A, General Science..... $2 (gold) per year
Section B, Medicine..... 3 (gold) per year
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Each section is separately paged and indexed and the number will appear as fast as material is available.

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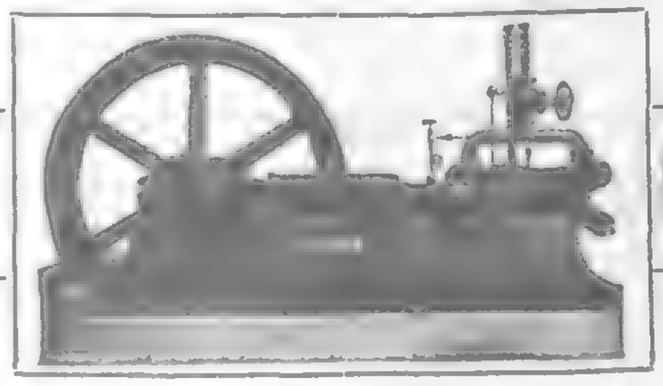
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Manila P. I. June 11, 1907.

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Purchasing Agent.

Sealed proposals in triplicate will be received at this office up to 11 a. m. June 25th, 1907, when they will be opened in the presence of the attending bidders, for the Lighterage of all supplies to be received by the Insular Government during the fiscal year ending June 30, 1908.

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Manila, P. I., June 15, 1907.

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Manila, P. I., May 28th, 1907.

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June 24.

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July 1.

Proposals for furnishing 6,600,000 lbs. of frozen fresh beef and 200,000 lbs. of frozen fresh mutton during fiscal year ending June 30, 1908.

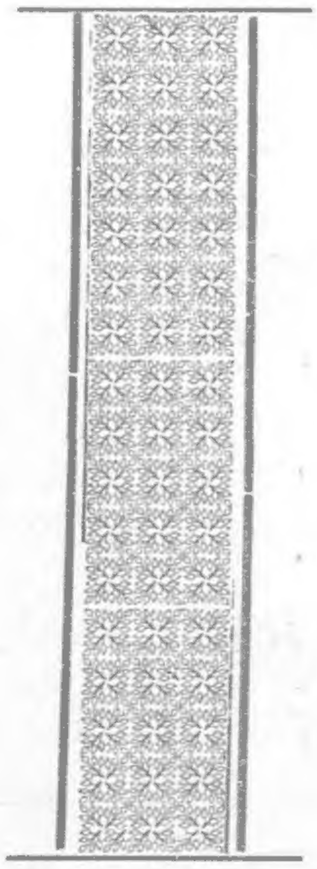
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August 1.

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Sealed BIDS or PROPOSALS will be received until 12 m., September 14, 1907, for furnishing and delivering at ship's side in Manila, P. I., certain valves and sluice gates for use in the gravity water supply of the City, in accordance with the plans and specifications on file in the office of said Board.

Each proposal must be accompanied by a certified check for one thousand dollars ($1,000), drawn on a bank established in Manila, P. I., and made payable to the Municipal Board of the City of Manila. For the convenience of bidders in the United States, said check may be deposited with the Chief of the Bureau of Insular Affairs, Washington, D. C., in which event it may be drawn on a Washington or New York bank.

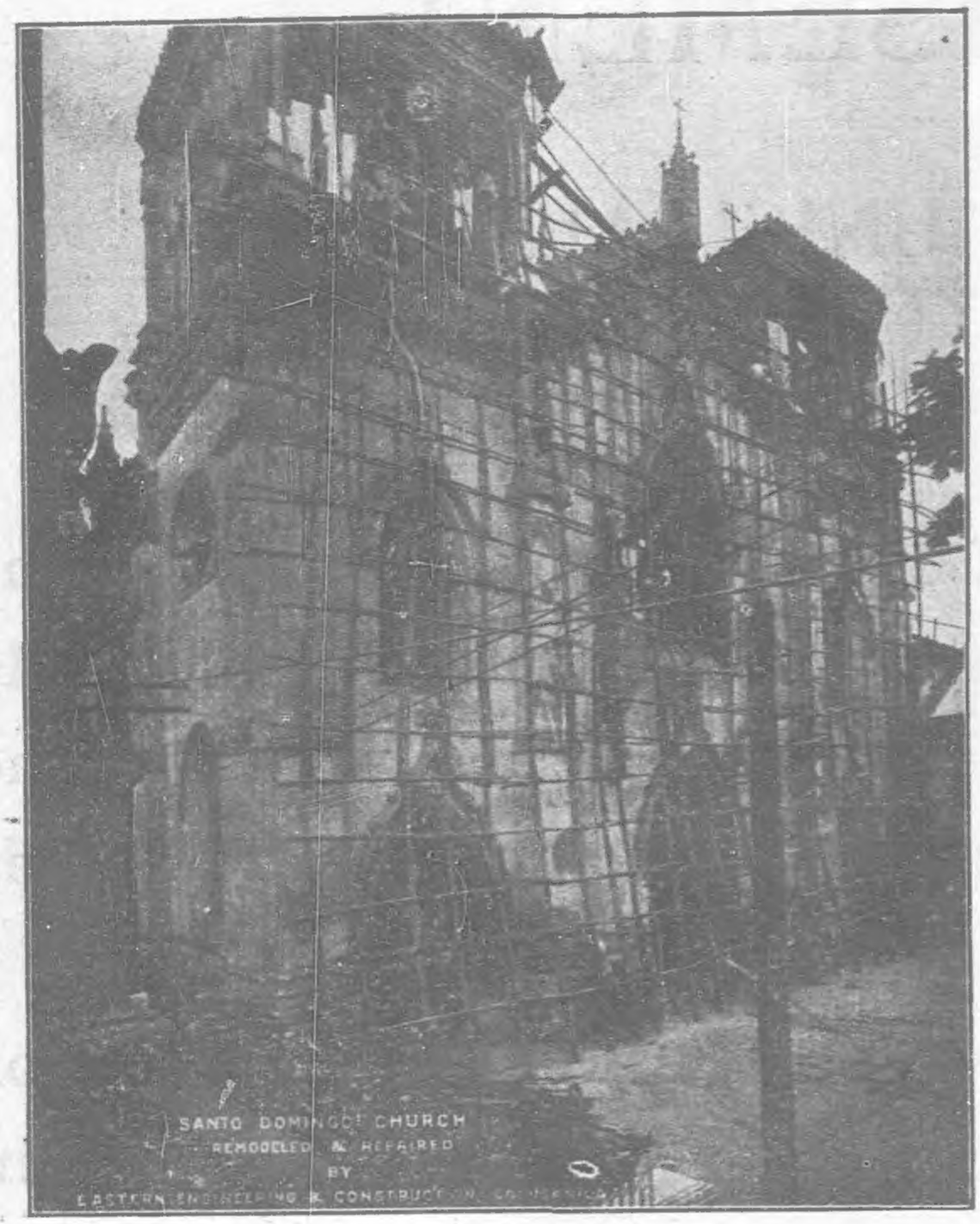
Specifications, instructions to bidders, general plans, and blank forms of proposals may be obtained at the office of the Board, and Bureau of Insular Affairs, Washington, D. C.

The right is reserved to reject any or all bids.

JOHN M. TUTHER,
Secretary of the Municipal Board.

J. F. CASE,
Chief Engineer.

N. B.—Plans and specifications on file at the office of the "Far Eastern Review," 91-93 Wall Street, New York.



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